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GENTLEMEN EMINENT IN SCIENCE AND LITERATURE.

THE

FIRST AMERICAN EDITION,

Corrected and improved by the addition of numerous articles relative to

THE INSTITUTIONS OF THE AMERICAN CONTINENT,

ITS GEOGRAPHY, BIOGRAPHY, CIVIL AND NATIONAL HISTORY, AND TO VARIOUS DISCOVERIES IN

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THE AMERICAN EDITION

OF THE NEW

EDINBURGH ENCYCLOPÆDIA.

THERMOMETER.

THERMOMETER; from the Greek words θεϱμος, *heat*, and μετϱον, *a measure;* an instrument adapted for the comparative estimation of the temperature of bodies.

That the idea of any instrumental measurement of heat is wholly of modern invention seems beyond a doubt, since in the writings of the ancients we find no trace of any such comparative scale except the rude indications of our natural feelings. Since we are absolutely ignorant of the state of substances deprived of, or saturated with heat; since our senses, though adapted to the perception of it, are incapable of forming any accurate measure of its effect, or of computing its real quantity upon any independent standard as we can do the pressure of the atmosphere by knowing the weight of an equiponderant column of mercury, we are obliged to have recourse to a relative, not an absolute scale, and establish an arbitrary measure of heat by the extent of one of its acknowledged effects, that of *expansion.* (See the Article HEAT.)

Hence, it is obvious, that in order to conceive the thermometer to be a true measure of heat, we assume that by equal increments of that agency, the expanding substance employed is uniformly enlarged in bulk, a postulate not of easy proof, but which it has been ascertained in most cases of importance is nearly true. But this we shall explain more fully afterwards; in the meantime we propose to give some account of the invention and history of the simple thermometer, with the various improvements which it has gradually undergone, and after some directions for its practical construction, proceed to the various ingenious modifications which it has received for different scientific purposes, and we propose to conclude with some considerations on the application of the thermometer to use, and the defects to which it is liable, without the most scrupulous attention.

Like most other important discoveries, that of the thermometer has had several claimants, the respective merits of whom it seems nearly impossible at the present day definitely to determine. Though by some Galileo has been considered as the true inventor, and by others, Father Paul Sarpi, the Venetian, this honour chiefly rests between Sanctorius, an Italian physician, and Drebbel, a Dutchman, both men of ingenuity and original minds. Many moderns support each of these claims, but Sanctorius (or Santorio) has, on the whole, most in his favour, since, as Martine justly observes,* no one but he demanded the honour of an inventor during his lifetime. His *Commentaries on Avicenna*, published in 1626 are very interesting, since they contain descriptions and curious wood cuts of the various forms of the thermometer which he proposed for medical purposes; and the extent to which he carried it in other matters, is shown by his attempt described and figured at folio 22 of that work, to compare the heat of the sun's and moon's rays, an attempt which afterwards became one of the most delicate in natural philosophy.

Perhaps Sanctorius and Drebbel invented much about the same time this instrument, a circumstance by no means improbable, considering the then advancing state of physical science. Be this as it may, the instrument contrived by each was precisely similar, in which air was employed as the expanding substance, which in several respects is remarkably well fitted for this application.

The air thermometer, as shown at Plate DXXIV. Fig. 1, consisted of a ball of glass A with a stem B nearly filled with air, but having the lower part of the tube occupied by a coloured liquor, which, when the air in A was expanded, was forced into the recipient C, and hence a scale being applied to the stem, the dilatation of the enclosed air by heat was marked by the descent of the coloured fluid. In this form the instrument was obviously unfit for trying with any ease the temperature of fluids.

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* *Essays on Thermometers*, p. 2, where the authorities in this controversy are quoted.

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Boyle therefore subsequently proposed to include both the air and the coloured fluid in one bulb as shown at Fig. 2, where the tube AB which is open at top, reaches below the surface of the fluid nearly to the bottom of the receptacle C, into the neck of which the tube is hermetically sealed. The same philosopher, however, demonstrated the grand defect of the air thermometer, that by a change of pressure in the atmosphere, as shown by the barometer, the elasticity of the inclosed air is altered independently of temperature, so as to render the indications of the same instrument not comparable at different times. The air thermometer was subsequently modified by the ingenious Hooke, in order to act as a barometer, which it obviously does, if the effects of temperature be corrected and those of pressure alone shown, just as on the other hand, if the result of variable pressure were neutralized, that of temperature would be truly expressed. Hooke attached a mercurial thermometer to the original instrument, the temperature of which thus indicated gave the data for separating the influence of dilatation caused by heat, which was performed by means of a sliding scale. By this elegant modification Hooke converted the air thermometer into a marine barometer, which, however, was soon abandoned from the absorption that was found to take place of the excluded air by the coloured fluid. This defect has more lately been in a great measure remedied by the substitution of hydrogen gas instead of the common included air, by Mr. Adie, who has revived this instrument under a very elegant and portable form, and under the name of the sympiesometer. See METEOROLOGY.

The only other air thermometer we intend to notice is that of Amontons, who made the indicial fluid a column of mercury twenty-eight French inches long, so that the included air was subjected to the pressure of two atmospheres; by this method he was enabled to measure high temperatures, such as that of boiling water, without a scale of such great length as the dilatation of air under the common pressure would have required. It was, however, subject to the same great defect as the Sanctorian thermometer, and was besides very unwieldy and liable to accident. In the seventeeth century a modification of the air thermometer was proposed by Van Helmont and by Sturmius, which has recently been revived under the names of Thermoscope and Differential thermometer; as this, however, does not belong to the simple form of the instrument, we shall give some account of it in another part of this article.

The defects of the air thermometer having been duly appreciated by the Florentine *Academia del Cimento*, that enterprising body published, in the first volume of their transactions,* a description of a new thermometer, in which spirit of wine was used as the expanding substance, which, as it might be hermetically sealed up in a glass tube or bulb, was free from any defect arising from pressure, as well as the possibility of any loss of fluid by evaporation. This instrument was constructed much in the same way as at present, the spirit being dilated till it filled the whole tube, when it was quickly sealed, and on cooling, the fluid retired, leaving nearly a vacuum above it. The great defect of the *Florentine weather glass*, as it was commonly called, was the want of any fixed scale of graduation, on which account no instrument except those graduated by the original one of the academy, could be comparable with any other, the only direction being that the cold of ice and snow should make it stand at 20 deg. and the greatest summer heats at Florence, at 80 degrees.

The spirit thermometer was faulty in several other respects, yet it cannot but be thought fortunate that this fluid, which is esteemed the *second best* for filling thermometers, should have been so early thought of. The Florentine academicians sometimes bent the tube of their instrument into a toruous form, but this does not appear to be the first attempt of the kind, for we observe at fol. 220 of Sanctorius's Commentaries on Avicenna, a curious figure of a similar contrivance.

From the invention of the spirit thermometer may be dated the epoch of the application of truly scientific effects to the art of thermometry. Boyle having received one of the Florentine instruments in England, set himself to effect some radical improvements upon a contrivance which it was obvious was capable of shedding new light and precision over every branch of natural inquiry. He therefore proposed, as a fixed point for graduation, the thawing of oil of aniseeds, which he preferred to the freezing of water, (another point he also mentioned,) as being more easily obtained in all seasons of the year, and because he had great doubts as to the constancy of the point of freezing of different kinds of water. Indeed this doubt served for long after to delay the adoption of the fixed points at present employed. Derham, Halley, Musschenbroek, and other philosophers, till far on in the last century, believed that water froze at different temperatures in different latitudes, which Martine,† only ninety years since, cites some experiments of his own to disprove. Besides this, Boyle falls into another mistake in not taking two fixed points, but endeavouring to compute the absolute expansion of the spirits, and graduating the scale to ten-thousandths, or some other fixed number of parts of expansion, a proposal which, though extremely philosophical in the abstract, is too difficult of execution to be successfully adopted in practice. A similar plan was proposed by Hooke.‡

The acute Halley afterwards turned his attention to this subject of growing importance. He first proposed the temperature of deep pits for a standard, naturally enough suggested by the constancy of the thermometer observed by De La Rive and others, in the caverns of the Observatory at Paris. But the difficulty of finding such situations, independently of the variation of their temperature in different latitudes, was enough to set aside this proposal. Halley afterwards devised the excellent standard derived from boiling liquids, though he did not appreciate its real merit. He tried the point of vaporization of water, mercury, and spirit of wine, and unfortunately preferred the latter; a point very uncertain, as depending greatly upon the strength of the fluid. The boiling point of water, though Halley very much overlooked it, he found to be very steady in its indication.* Nor is it easily affected by minute accidental admixtures. The principal source of error is that the vaporization of fluids is affected by the state of atmosphere at the time, as to pressure, the temperature being highest when the pressure is greatest, and the reverse. By subsequent examination, this source of error has become merely the object of an equation table which will be given in the course of this article.

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* Saggi di Naturali Esperienze.

† Essays, p. 15.

‡ Micrographia, p. 39.

We have already mentioned that Amontons constructed an air thermometer which could measure temperatures as high as boiling water, which he held as a fixed point in graduation, but hitherto the importance of the points of freezing and boiling water was imperfectly estimated, and had never been united in graduating the same instrument. It was reserved for the powerful mind of Newton to put this branch of science upon the same secure footing with every other which he had studied. Had not his mind been led to more magnificent fields of investigation, he would probably have effected the admirable refinements in thermometric science to which he only led the way, rejecting the partial views of his predecessors, and laying the foundation, as that of every philosophical superstructure should be laid, in principles as rigidly accurate in theory as they are simple and consistent in their application.

Newton rejected spirit of wine as a thermometric fluid, as having too low a range, and selected linseed oil as being capable of bearing unaltered intense heat and cold. Like Boyle he computed the absolute expansion of the fluid in ten thousandths of its bulk, but he showed his judgment in not making this the basis of practical graduation, which was always to be performed by means of two fixed points, and dividing the interval into an arbitrary number of degrees. He found that supposing the mass of oil at the temperature of melting ice to be = 10000; at the heat of the human body it was = 10256, boiling water = 10725, and of melting tin = 11516. As an empirical measure he divided the space between melting snow and the common temperature of the body into 12 parts, and proceeding from the data above given, he numbered the boiling point $\frac{725\times12}{256} = 34$. The principle of his thermometer, and a scale of various temperatures examined by it are to be found in a paper by Newton, printed anonymously in the 22d Vol. of the *Philosophical Transactions* in 1701, and are also partly given in the *Principia*.

The oil thermometer of Newton, though a happy approach to a universal standard, had striking defects. The fluid, indeed, does not boil below 600° of Fahrenheit, nor does it freeze with a great degree of cold; its expansibility too is great, being not much less than that of alcohol; but with all these recommendations, linseed oil has been found so viscid as to render any accuracy of observation impossible, and from the quantity which always adheres to the tube, to make the actual height very uncertain.

We now come to mention the greatest improvement made upon the thermometer since the period of its invention,—the practical introduction of mercury as the expanding fluid. Halley had proposed this substance, but was prevented from trying it practically, by the consideration of its low expansible power, which indeed he underrated, making it $\frac{1}{74}$ between freezing and boiling water, instead of $\frac{1}{55.5}$ as has been most lately determined. This defect was certainly of consequence in the 17th century, when the art of making thermometers with bores of great tenuity was neither understood not appreciated; and for the advantageous introduction of mercury as a fluid, a proportionate improvement in manipulation was requisite.

This practical discovery appears, as far as the testimony of contemporary writers can guide us, to be due to Olaus Römer, the ingenious discoverer of the progressive motion of light, who, according to Boerhaave,† likewise proposed the scale now known under the name of Fahrenheit's, and so early as the year 1709 observed the mercury to sink by a natural cold to the zero of that scale; but it is more commonly conceived that Fahrenheit himself made that observation, and founded his scale upon it, which was contrived in the year 1720, and described to the Royal Society of London in 1724.‡ From this period the thermometer became of scientific utility, and its indications being founded upon fixed principles, gave the assurance that all instruments made with equal care would be strictly comparable. There is even now, after the lapse of a century, no prospect of materially improving the plan of the simple thermometer, or of finding any substance fitter than mercury for forming a scale of heat. In fact it unites the most important qualifications.

1st, It is found to measure with more accuracy than any fluid hitherto employed by equal spaces, equal increments and decrements of heat, which being the fundamental postulate in all thermometric fluids, is of the most primary consequence. 2d, The facility with which it is divested of air. Though this might at first sight appear a trifling recommendation, it is found in practice one of the highest value; for the difficulty with which spirit of wine is freed from particles of air is one great obstacle in forming good instruments with that fluid, the air deranging much its operations, and giving an independent degree of expansibility. Oil is still more faulty in this respect, but mercury, from its immense cohesion of parts, the high temperature to which it may be brought, and the power of distilling it readily into a state of almost chemical purity, has a decided superiority over every other substance yet applied to the purpose. 3d,

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* Philosophical Transactions.

† Boerhaavii Chemiæ, i. 720.

‡ Phil. Trans. vol. xxxiii.

The range of the mercurial scale is so great, and between such limits as to be extremely convenient for all ordinary experiments; it does not boil under a temperature of 660° of Fahrenheit according to Dalton, or 656° according to Petit and Dulong, and it does not freeze until the extreme cold of — 39 of the same scale. Deluc, from whom the principal facts of the thermometric properties of mercury have been taken,[*] is much mistaken in asserting that mercury bears a more intense cold than alcohol. The experiments made about the middle of the last century were very erroneous in regard to extreme degrees of cold, since as mercury contracts enormously at the moment of solidification, it was supposed that a temperature of — 261 of Deluc's scale, or — 489 Fahrenheit, had been measured without the freezing of mercury. On the other hand it was asserted,[†] that the French Academicians had found the spirits in Reaumur's thermometer to freeze at — 37 at Tornea in Lapland. This proves nothing but the weakness of the spirits employed, which indeed were always adulterated with water, as will be shown when we describe that thermometer. Pure alcohol has never yet been frozen by any cold, natural or artificial, though it has been reduced as low as — 91 Fah. by Mr. Walker, of Oxford, and it has even been alleged that a temperature of — 150° has been produced.[‡] For intense cold, therefore, such as was frequently experienced in Captain Parry's late voyages, spirit thermometers are requisite, but within all ordinary bounds, as we have already stated, mercury enjoys an ample and convenient range.

4th, Mercury accommodates itself more speedily to the temperature of the medium in which it is placed, than any other fluid, gases excepted. The theory of the heating and cooling of bodies is a very curious one, and till lately was very imperfectly understood. From its great importance, a short outline of it may here find a place. Equal quantities of heat thrown into different bodies do not necessarily produce the same temperatures in each. An equal bulk of mercury having a temperature of 100° and of water at 40° will not produce a mixture having a temperature at a mean of these, or 70°, as equal volumes of water would have done; the resulting temperature will only be 90°, showing that the 40° of heat lost by the mercury when transferred to the water had only the power of raising it 20° of temperature. Speaking generally, therefore, mercury is capable of receiving only half as much heat as water without being raised to a higher temperature, or to use the language of modern chemistry, the *specific caloric* of water being 1, that of mercury by equal volumes is 0.5.[§] Now it is easy to see, that as the quantity of heat required to raise mercury to any temperature is less than is requisite for any other fluid, the acquisition of temperature will, *cæteris paribus*, be more quickly accomplished. Add to this that mercury combines the rapid conducting power of a metal with conduction by locomotion, which is peculiar to the fluid state, and which, communicating the temperature through all its parts, facilitates the change of condition. Dr. Trail found, (Nicholson's Journal, xii. p. 137.) by a series of experiments, in which the real conducting power of substances was alone indicated, that mercury conducted a definite portion of heat in 15″ for which alcohol required 10′ 45″ making the conducting power as 43 to 1. From these circumstances a mercurial thermometer acquires much sooner the temperature of any medium than one of alcohol; a fact which, though long since ascertained, was a subject of great surprise and perplexity to philosophers. The determination of *specific heats* being one of great nicety, experimenters vary very much in their results, but probably we are not far wrong if we consider alcohol to possess double that of mercury. As a satisfactory proof of the superiority of mercury in this respect, we shall quote a specimen of Martine's experiments on the subject, which were among the first to throw light on the subject, taken from his little volume of Essays on Heat,[‖] a work which at any period would have done honour to its author, and for the time at which it was written, certainly one of uncommon merit. The following experiment was made by placing two thermometers, one containing 3½ ounces of water, the other nearly 48 of mercury (or equal volumes) before a large fire.

Times.	Water heating.	Mercury heating.	Times.	Water heating.	Mercury heating.
0′	48	48	32′	83	96½
4	52	58	36	85	97
8	57½	69	40	87	98
12	63	78	44	89	99
16	68	84½	48	91	100
20	72½	89½	52	92½	100
24	77	92½	56	93½	100
28	80	95	60	94	99½

Here we observe that the mercury reached the point of 92½° in 24′, for which the water required 52′, whence to find the relative capacity we say as 52 : 1 : : 24 : 0.46, or exactly the most modern deduction. Mercury being thus compared to water as a standard, the following experiment by the same author gives the relative value of spirit of wine:

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[*] Modifications de l'Atmosphere, i. 285.

[†] Maupertuis, figure de la Terre, p. 58.

[‡] We know not upon what authority this is stated in a late publication.

[§] Henry's Chemistry, 10th edition, vol. i. p. 146. The difference between specific caloric and capacity for caloric, is sometimes ill explained, or not explained at all, in chemical works, which use both terms. The former expression is properly applied to substances taken by equal *weights* and the latter by equal *volumes;* yet they are sometimes interchanged. See Henry, p. 151; and we think that the latter term might very advantageously be done away with. See also Murray's Chemistry, i. 392, &c. To prevent confusion, it is proper to add, that the *specific heat* of French writers is identical with the *absolute caloric* of Crawfurd and others. Such abuses of nomenclature ought to be discarded as fast as possible from science.

[‖] Page 77. The specific heat of mercury by volume is usually stated at .445, water being 1. That of alcohol varies exceedingly under the hands of different observers, some making it almost equal to water, which seems too great, and on the other hand, Mr. Leslie (Essay on Heat, p. 548) has certainly rated it too low in making it only .57.

Times.	Water heating.	Spt. Wine heating.	Times.	Water heating.	Spt. Wine heating.
0′	52	52½	32′	80	88
4	53	54	36	83	91
8	56½	59½	40	85½	93½
12	61	65½	44	88	96
16	65	71	48	90	97½
20	69	76	52	92½	99½
24	73	81	56	94	100
28	77	85	60	95	100

Here the spirit of wine acquired the temperature of 88° in 32′, for which the water required 44′. Hence 44 : 1 : : 32 : 0.73 the relative specific heat. We think, therefore, that the fourth recommendation of mercury is proved, as acquiring any temperature in a shorter time than any other thermometric fluid, for of course the rapidity of cooling depends on the very same circumstances as that of heating.*

5. The fifth and last qualification of mercury is the perfect uniformity of its nature and properties, wherever it is procured, requiring only the operation of a careful distillation to render it fit for all thermometric purposes, and different specimens perfectly comparable. In this it differs remarkably from alcohol, which it is impossible to procure everywhere of precisely the same degree of purity, which greatly affects the extent and regularity of its expansions.

We have entered the more fully into these properties of mercury, as the consideration of them forms the whole basis of the first theory of the thermometer; we therefore see how great a benefit Reaumur and Fahrenheit conferred upon science by its introduction. The instruments made by the latter in Amsterdam were extremely neat, vying in portability and elegance with the productions of modern artists. Sometimes the scale was composed of paper, and being fixed in the form of a scroll round the tube, the whole was inclosed in a glass case, hermetically sealed. A very elegant instrument of this description we have seen, made by Prius, Fahrenheit's partner, at Amsterdam, which once belonged to the late Baron Maseres. Dr. Patrick Wilson of Glasgow used to make very beautiful thermometers on the same construction. Sometimes, particularly abroad, the scale was formed by a roll of paper inclosed within the glass tube BC, Plate DXXIV. Fig. 3, attached by a solid bend to the top of the thermometer at C. This plan is now out of use in this country; but we have often seen it employed by artists in Italy. Mercurial thermometers are more usually made in this country in a style resembling Fig. 4, the scale being of ivory, and sometimes the bulb and stem project below from the scale for the purpose of greater delicacy; the bulb too is then generally made elongated like the instrument of Fahrenheit.

The scale adopted by this philosopher was rather an arbitrary one, and the motive of its adoption we have not been able quite satisfactorily to discover. Several of the older writers whom we have consulted, such as Boerhaave,† simply affirm that at the zero of the scale, the mercury was conceived to be divided into 11124 parts, an expansion of one of which indicated a degree, but how that arbitrary number was discovered is not indicated. Muschenbroek, on the other hand, leads us to believe from the details of the construction of the thermometer in his Essais de Physique, § 948, that the highest point of the scale was placed at the boiling point of mercury, and the space between that and the zero of the scale divided into 600 degrees. This, however, seems hardly probable, since Fahrenheit always employed boiling water in preference to boiling mercury in graduating his instruments. Were we to propose any theory, we should conceive the most probable one, that this philosopher, in conformity with the principle so much attended to, previous to his time, attempted to make his degrees equivalent to $\frac{1}{10000}$ of the bulk of mercury at some fixed point, which, in fact, they are so extremely near, as to render the coincidence, if an accidental one, extremely remarkable. Some, we believe, suppose that he selected the number 64 as divisible by continued bisections for the interval in degrees between the freezing point and blood heat, but this appears a less probable hypothesis.

Be the origin of the scale what it may, its practical construction is well known. The space between freezing and boiling water is divided into 180°, and these degrees being carried down, the zero is placed 32° below freezing water, at a degree of cold, observed by Fahrenheit (though some insist by Römur) in Iceland, in 1709. The scale of the Mercurial Termometer has since been variously divided, but except two, these graduations have fallen into disuse. The first of these is usually called Reaumur's, though we shall presently show that it differs practically from his, and was really applied by Deluc: it divides the space between freezing and boiling water into 80°, whence the length of a degree is $\frac{180}{80}$° or 2¼° of Fahrenheit. Its zero is at the freezing point. The second is the scale of Celsius, the Swedish philosopher, though revived during the frenzy of the French revolutionists for decimal measures, under the title of Centigrade: it has 100° between freezing and boiling water, and its scale begins at the former point; the principal defects of this and the preceding graduation are, that the degrees are too large, requiring the application of fractions, and that negative quantities are perpetually occurring, both of which are in a great measure avoided in the less natural scale of Fahrenheit. The relative values of the degrees on these scales are expressed by the following formulæ, in which the degree on each scale is indicated by its initial letter.

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* We think it necessary to give only these decisive experiments of Martine's. For more modern researches, see Count Rumford's Essays. See also Deluc, Modifications de l'Atmosphere, i. 321.

† Chem. i. 174.

I. When *above* the zero of each scale.

$$F = \frac{9\,C}{5} + 32 = \frac{9\,R}{4} + 32$$

$$R = \frac{(F-32) \times 4}{9} = \frac{4\,C}{5}$$

$$C = \frac{(F-32) \times 5}{9} = \frac{5\,R}{4}$$

II. When *below* the zero of each scale.

$$F = \frac{9\,C}{5} \backsim 32 = \frac{9\,R}{4} \backsim 32$$

$$R = \frac{(F + 32) \times 4}{9} = \frac{4\,C}{5}$$

$$C = \frac{(F + 32) \times 5}{9} = \frac{5\,R}{4}$$

A very simple and useful rule may be added for the conversion of the Centigrade into Fahrenheit's scale. Double the number of degrees and subtract one tenth, and the result will be the number of degrees above the freezing point, to which add 32°. Thus, to convert 74° Centigrade into Fahrenheit, we say, $74 \times 2 = 148$ and $148 - 14.8 + 32° = 165.2$.

In De l'Isle's scale, the whole mercury at boiling heat is divided into 10,000 parts, each of which forms a degree counted downwards, so that the freezing point stands at 150°; a very unnatural graduation, but which is still used in Russia. The only other scale we shall notice, is one distinguished as being perhaps the most philosophical and convenient yet proposed, though it has never come into use; it is that of the late Dr. Murray of Edinburgh; he divides the whole range of mercury from freezing to boiling into 100 parts, whence if we assume — 40 and + 655 Fahr. for those points, freezing water will be at 99°, and boiling water at 347°. Here the degrees would be of a very convenient length, (about ¾th of those of Fahrenheit) and negative quantities could hardly ever be required.*

Such is an account of the mercurial thermometer to the present day, for it has hitherto undergone no alterations of consequence in its simple form. We must now, in order, say a few words upon the *real* thermometer of Reaumur, which was constructed with spirit of wine, though in point of date it followed Fahrenheit's.

Reaumur conceived that he had ascertained that 1000 parts of strong spirit of wine expanded to 1087 at the heat of boiling water, he therefore diluted the fluid till he found the dilatation reduced to exactly 80 parts, which formed his degrees. Now this being a tentative process, ought by all means to be excluded from the practical construction of thermometers, and besides, all attempts which were then made to graduate upon the principles of absolute fractional expansion were fruitless in a philosophical point of view, for the expansion of the glass in which the fluid was contained, was *always overlooked*, as well as the inequalities of the dilatation of the substance itself. But the great error of Reaumur was in the determination of his fixed points, for since he never allowed the spirit to boil in the tube at the upper extremity of the scale, instead of being 212 Fahrenheit, it was only about 175, as Martine has justly shown; the bulbs of his thermometers were likewise so large, that the freezing point was about 2° Fahrenheit too high. This thermometer was therefore a most imperfect instrument, and now wholly abandoned; we think it therefore unnecessary to enter upon it more fully, but refer for a full description of it to the work of Deluc,† in whose time the true value of Reaumur's degrees was of some importance, as the instrument had been much employed in France. That author afterwards applied the octogesimal division to the mercurial thermometer, which, as we have already observed, usually goes under the name of Reaumur's scale, for the conversion of which, into Fahrenheit's, we have already given directions.

Two more modern thermometers remain to be noticed. The expansion of metallic substances from its small amount, and the degree of heat to which it might be applied, early pointed them out as suitable indicators of intense temperatures, and under the name of pyrometers they were employed, with various modifications, during the last century (See PYROMETER.) The beautiful and refined application of the unequal expansibility of metals to the formation of a compensation pendulum, and especially the still more delicate contrivance for the compensation of the balance of a chronometer, probably suggested to Messrs. Breguet, the distinguished Parisian artists, the possibility of rendering the minute variation of metallic expansion sufficiently visible for ordinary thermometric purposes. Their instruments are of two descriptions. One in the form of a watch is shown at Plate DXXIV, Figs. 5 and 6, where, in the former, which represents the interior, the expanding metallic bar *a a a a* forms a double curve; it is composed of two laminæ of steel and brass firmly united, the excess of the dilatability of the latter above the former causing the curve to expand and contract, thus acting upon the lever *d*, the opposite and longer arm of which consists of an arch-head, with fine teeth upon its edge, which act upon the small wheel *g*, upon the axis of which the needle which traverses the dial, shown in Fig. 6, is fixed. A fine gold wire spring acts upon the wheel, so as to keep the lever *d* always in contact with the extremity of the expanding bar. The most modern and beautiful form of the instrument is shown at Fig. 7, in which the metals employed are platina and silver, with a slip of gold interposed, as being of intermediate expansibility, the whole is flattened to an extreme tenuity and then formed into a spiral spring, to the lowest turn of which is attached an index which traverses a horizontal dial. This instrument is far superior to the last, and is altogether one of the most elegant philosophical instruments we ever saw. We had lately an opportunity of inspecting a number of them at M. Breguet's own manufactory.

The only other thermometer we shall notice, is one proposed by M. Achard of Berlin for measuring high temperatures. The substance employed was the well known fusible metal composed of bismuth, lead, and tin, which liquefies below the temperature of boiling water; the bulb was proposed to be of porcelain. This idea is a very ingenious one, but from practical difficulties, never has, as far as we know, been brought into use, and we suspect it never will. The only instrument of the kind we have seen, failed, from the sudden expansion of the metal in the act of consolidation, which burst the bulb.

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* Dr. Blagden partly anticipated Dr. Murray in his paper on the Congelation of Mercury, (*Phil. Trans.* vol. lxxiii.) by proposing that point as the zero of the thermometric scale.

† Modifications de l'Atmosphere, i. 352.

Having finished our account of the simple thermometer, let us pause a moment and apply this *instantia crucis* to the whole subject. How are we sure that any fluid corresponds by its expansions to equal increments of heat? The question admits of no mathematically demonstrable answer, for every attempt to measure heat, (a principle, as we have observed, admitting of no independent or absolutely comparable measure,) involves a certain degree of hypothesis. By far the simplest and most convincing plan which has been proposed, is the mixture of definite volumes of water at different temperatures, attempted first by Renaldini of Padua, but not accurately performed till undertaken by Dr. Brooke Taylor, who made his experiments in 1723 with the oil thermometer,* yet Deluc attributes the first adoption of the plan to Le Sage, who published an account of it in 1776.† Deluc himself is the first who has made these delicate researches with sufficient nicety, and has found that even mercury, which we have already stated to be the most accurate thermometric fluid, is liable to small deviations from the *true* scale of heat discovered by the method of mixtures just noticed; the accuracy of the principle depends on the assumption that the *specific caloric* of hot and cold water is the same, for if not, equal weights of both would not have a temperature exactly at the mean of the two, but somewhat different, as explained in the case of the mixture of mercury and water. Our limits necessarily confine us to a very brief sketch of this refined part of the subject.

The following results by Deluc of the absolute quantities of heat in every 5° of his thermometer may be taken as very correct, since one accurate observer‡ has considered the deviation to be somewhat too small, and another§ too large.

Mercurial Therm.	Corresponding real Temp.	Diff.	2d Diff.	Mercurial Therm.	Corresponding real Temp.	Diff.	2d Diff.
80	80.00	4.72	0.00	35	36.40	5.08	0.02
75	75.28	4.72	0.07	30	31.32	5.10	0.00
70	70.56	4.79	0.02	25	26.22	5.10	0.08
65	65.77	4.81	0.00	20	21.12	5.18	0.02
60	60.96	4.81	0.08	15	15.94	5.20	0.11
55	56.15	4.89	0.00	10	10.74	5.31	0.12
50	51.26	4.89	0.08	5	5.43	5.43	
45	46.37	4.97	0.03	0	0.00		
40	41.40	5.00	0.08				

We have added the second differences, which show a considerable irregularity attributable to errors of experiment. We may add, that the cause of the near coincidence of mercury with the stages of absolute heat appears to be owing to the distance of the range of temperature above given, from the boiling point of the fluid, for near that point, all substances show great irregularities; this appears from the following table by Petit and Dulong, in which the temperatures are centigrade.

Real Temperature.	Mercurial Thermometer.	Expansion of Mercury.
0°	0.00	0
100°	100.00	$\frac{1}{5550}$
200	204.61	$\frac{1}{54\cdot25}$
300	314.15	$\frac{1}{53\cdot00}$

Mr. Dalton, with that fondness for general and speculative conclusions which that distinguished chemist has too often given way to, has suggested that mercury and all other fluids expand in a ratio proportional to the squares of the temperature above their respective freezing points, but this opinion is by the best observers considered destitute of foundation. M. Biot‖ has probably simplified the matter as far as is practicable, by a reference to the expansibility of a variety of substances to that of mercury by the following formula;

$$^{\delta}t = at + bt^2 + ct^3$$

where δ_t is the true dilatation in parts of unity of volume at the temperature of melting ice, t being the temperature on the mercurial thermometer, and a b c coefficients depending upon the nature of the fluid. By this formula he has even satisfied the conditions of the singular phenomena of water, the only known fluid which does not in all parts of the scale expand with heat, its point of maximum density and minimum volume being between 39° and 40°,¶ below which it expands until congelation.

The deviations of the mercurial thermometer from the truth we have seen to be small. But a far more practically important inquiry of the same nature regards the spirit thermometer, which, as it is necessarily employed for several purposes, it becomes desirable to ascertain whether these irregularities are so very great as has been stated. We confess that it is with diffidence that we object to the conclusions which Deluc, and all who have succeeded him in the same investigation, have drawn as to the indications of the spirit thermometer; yet we think we can produce unanswerable arguments to show that they have done great injustice to the instrument, by subjecting it to trials for which it was never intended.

Deluc, in his work, does not describe, so far as we know, the precautions he took to ensure the accuracy of the upper term of adjustment in the spirit thermometer, for which he employs boiling water as in the case of mercury. He plunges the instrument (the fluid of which boils at 175° Fahrenheit,) into freezing and then into boiling water, divides the interval into 80 degrees, which he compares with the mercurial thermometer at every 5°, and gives the defect as the error of expansion. But we are disposed to ask Deluc, who blames Reaumur for not suffering the spirit in his thermometer to boil, what does he gain by this procedure; how does he pretend to mark the dilatation of a fluid above a temperature when a considerable portion of it must confessedly pass into vapour? Deluc gives no explanation of the point, and we find his table of the inequality of the expansion of alcohol quoted in almost every work on the subject, without the slightest comment on its derivation; the discrepancies are so enormous, (amounting to above 12° Fahr. at a maximum,) as to convince us, if correct, that such a fluid is absolutely unfit for thermometric measurement. M. Biot, however, in his excellent work already quoted, says expressly, that the ordinary method of graduating alcohol from mercurial thermometers, is extremely incorrect, for nothing is easier than to raise the spirit thermometer to the temperature of the boiling point by carefully freeing the tube of air and permitting an elastic atmosphere of vapour to be formed above it, which shall prevent, by means of pressure, the vaporization of the fluid, and enable it to attain an unnatural temperature.[*] This we readily admit; but in the first place, it presupposes the conversion of a portion of the fluid into an invisible and elastic form, which obviously lowers the height of the remainder in the tube, since it is abstracted from it; and what deserves notice, the quantity of vapour required to repress by its elasticity the tendency of the alcohol to vapourize, *must vary with the length* which the tube may happen to be, so as to occupy it with vapour, having the great elasticity of 67 inches of mercury[†] to enable it to reach the temperature of boiling water. Not to speak of the natural contraction of the fluid itself under this pressure, or the expansion of the glass bulb, we would ask by what rule we can expect a substance in so unnatural a condition to be a true measure of equal increments of heat by expansion, when that very substance would be *naturally* expanded at the same temperature, not by the previous laws of dilatation, but after rendering latent an immense quantity of heat, into a subtile vapour many hundred times rarer than in its fluid state. We are aware that in a real vacuum it may be said that alcohol boils far below 175°, and that it is repressed below as above that temperature, by the force of its own vapour, but this very force is so small, differing from that at the natural boiling point by a fraction of an atmosphere, and therefore the conversion of so small a quantity of fluid into vapour being necessary, that it may well be overlooked; besides, that in theory we do not think there *ought* to be, and in practice there never *is* an exclusion of air from above the thermometric column, for we shall soon show how much the value of such a vacuum has been overrated in mercurial thermometers.

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* Philosophical Transactions, 1723.

† Deluc, Mod. de l' Atm. i. p, 223, 285.

‡ Dalton.

§ Crawford on Animal Heat.

‖ Traité de Physique, i. 210.

¶ As determined by Dr. Hope, Professor of Chemistry in the University of Edinburgh, by the most elegant experiment which has been applied to the investigation.

But the most satisfactory proof of the inaccuracy of Deluc's method is obtained from the following consideration, which is the only attempt made, though an indirect one, which we have been able to discover, to correct the important misconceptions which have prevailed on the subject. Dalton, whose accuracy as an experimentalist is undoubted, has confirmed the assertion of Deluc, that while spirit of wine expands 35 parts between the freezing point and 122° Fahr., it expands 45 between 122° and 212°, but the same chemist has stated, that taking 170° as the upper point, which may be determined with great accuracy by a careful comparison with the mercurial thermometer, he found the spirit which occupied 1000 parts at 50° to fill 1079 at 170° and at 110°, the mean distance where the error should have been at a maximum, he found it to occupy 1039 parts, or *half a division below the true mean;* from which it appears that almost the entire error exists, as was to be expected, in the 40° F. of Deluc's thermometer nearest the boiling point of water, which, therefore, it is manifestly unfair to carry down through the scale, and charge the whole instrument with an enormous error of expansion, amounting at a maximum, to *one sixteenth* of the whole interval between boiling and freezing water. We shall now quote the latest table of the expansions of alcohol, from experiments performed on the method of Deluc by Dr. De Wildt,[‡] for every 5° of the octogesimal scale.

Mercury.	Spirit.	Mercury.	Spirit.
— 45° =	— 28.°50	+ 20° =	+ 16.°48
40	25. 92	25	20. 97
35	23. 19	30	25. 60
30	20. 32	35	30. 38
25	17. 30	40	35. 31
20	14. 13	45	40. 38
15	10. 82	50	45. 60
10	7. 36	55	50. 97
5	3. 75	60	56. 48
0	0. 00	65	62. 14
+ 5	+ 3. 90	70	67. 95
10	7. 95	75	73. 90
15	12. 14	80	80. 00

Here we have another question to ask regarding this table, which shows a violence done to the natural properties of bodies not less than that of forcing alcohol to bear the heat of boiling water. How, we should be glad to know, does Dr. De Wildt pretend to measure the dilatation of mercury at — 45 R = — 76.°25 Fahrenheit? He must have forgot that the congelation of mercury has not hitherto been measured by this fanciful scale of the alcohol thermometer, but by the mercurial one itself, and found to coincide with 39° of Fahrenheit's scale,[§] a point determined beyond a doubt, and which is somewhat greater, though not nearly so much as De Wildt would have us to believe, than the temperature expressed by most spirit thermometers constructed in the ordinary way, as we hope it ever will be constructed, by a careful comparison with a good mercurial one. Hence it appears that De Wildt actually compared alcohol with mercury 37 degrees below its freezing point, if we are by any means to judge of temperature measured by a solid just reduced from fluidity. This, however, is impossible, since mercury contracts enormously after solidification,[*] we may therefore approximate to the real temperature of the first point in the table in this way; supposing the contractions of absolute alcohol equable with the temperature, as we have endeavoured to prove they are nearly, when at a moderate distance from the boiling point of the fluid, we may say, comparing it with the mercurial thermometer at the first term given above congelation (— 30 R) as 20.32 : 30:: 28.50 : 42.07. Whence we may estimate the thermometer to have sunk about 3 R = 7 F. too low, a circumstance quite accidental, since below the point of congelation, mercury sometimes contracts suddenly, so as to indicate a cold of several hundred negative degrees, sometimes contracts but little, indicating a temperature of — 50 or — 60 without moving. On the whole, therefore, we conclude that these experiments have done gross injustice to the spirit thermometer, and though the irregularities of that fluid are in all probability much greater than those of mercury, they have been exaggerated by the injudicious choice of the highest fixed point. Below zero of Fahrenheit, alcohol appears to be defective in its expansion, though by no means so much so as stated in De Wildt's table, (which makes the error about *twenty-two degrees* of Fahrenheit at the freezing point of mercury,) for in the numerous experiments of Hutchins, the spirit thermometers, at extremely low temperatures, sometimes did not differ so much from the mercurial ones, as these from one another, and they occasionally indicated temperatures not only as low, but even lower than the mercurial ones at a point higher on the scale than some of those at which Dr. De Wildt has attempted to compare the instruments.

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[*] See Traité de Physique, i. 40.

[†] According to Dr. Ure's Table. Phil. Trans. 1818.

[‡] Kastner Archiv fur die Gesammte Naturlehre, Dec. 1825.

[§] See the most ample testimony by Hutchins, Philosophical Transactions, lxxiii. 308. Cavendish, *ibid.* Blagden, p. 329, &c.

We are happy to be able to subjoin some extremely satisfactory evperiments from one of Captain Parry's late voyages,[†] on the comparison of alcohol thermometers by the best London makers, with mercurial ones, which fully confirm our ideas; the differences of the alcohol from the mercury, and with a single exception (+ 57 which perhaps is a misprint for 54) the spirit of wine, are remarkably constant, and the indications of the spirit are always *lower* than those of the mercury; the difference at + 58° being — 5 and at — 30°, — 6.5 a truly remarkable coincidence.

Mercury.	Alcohol	Spirit of Wine. Sp.Gr. 927
+ 58	+ 53	+ 57
+ 50.2	+ 44	+ 45.8
+ 3	— 0.5	— 2.2
— 3	— 10	— 8.7
— 12	— 18	— 19.2
— 16	— 24	— 24.5
— 30	— 36.5	— 36

The observations of absolute contraction are almost equally satisfactory. Dalton makes the expansion of alcohol = $\frac{1}{9}$ for 180° at higher temperatures, and though, according to one mode of experiment in Captain Parry's voyage it is made $\frac{1}{11.2}$ for 180° by observations between + 49.5 and — 36.5, yet by the mean of *four* trials in barometer tubes at temperatures ranging from + 46.5 to — 40 it is $\frac{1}{9.2}$, and what is perhaps most satisfactory, by direct observations on specific gravity between + 62 and + 5 it is $\frac{1}{9.8}$.

We own that our limits have enabled us to give but a hurried exposition of our opinion on this subject, but we hope that enough has been said to show that the subject requires a thorough re-investigation.[‡]

Before quitting the theory of the thermometer, we must mention an instrument quite original in its idea, and unconnected with the principles that have hitherto been detailed, and therefore requiring a separate place. Dr. Brewster, with that fertility of application in scientific subjects for which he is remarkable, has proposed the measure of the refractive power of a fluid (which varies with the density) as an index of temperature. In this plan, which we believe has not hitherto been published, "a hollow prism is filled with oil or any other fluid which changes its refractive power much with heat. The prism is fixed in a circular scale, and the angular distance between the two stationary points, when the refraction is at a maximum, is a measure of the temperature." The same philosopher ingeniously proposes the time which a bubble of air takes to pass through a viscid fluid from one end of a cylinder hermetically sealed to the other, as a measure of temperature. Indeed the viscidity of all fluids is sensibly altered by heat; we have seen a species of water clock which is used by the Indians, in which time is measured by the sinking of a copper cup floating in a vessel of water, and having a minute hole in the bottom through which so much water passes in an hour as exactly to make it sink. We have seen experiments made, in which the water employed was at different temperatures, and the time of descent was always diminished as the temperature was raised; this might be in a minute degree owing to the increased size of the hole in the copper cup, but principally from the diminished viscidity of the fluid.

We must now shortly detail the process of constructing thermometers, and the forms best fitted for their future application in practice.

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[*] See the above authorities, and Deluc's Account of Braun's experiments; also Walker's Papers, Philosophical Trans. vol. lxxviii.

[†] Parry's second voyage. Appendix.

[‡] We cannot help adding that M. Biot, while he upholds the principle of graduation from the boiling point, gives the strongest testimony to the regularity of the motions of alcohol within moderate limits; for in deducing the apparent expansion of this fluid *in glass*, his formulæ are founded on the admirable experiments of Blagden and Gilpin, which extend only from 32° F. to 100° F. In proving their accuracy by a correspondence with the total expansion given by Dalton for alcohol in glass, from — 8° Fahr. to + 162°, M. Biot is *obliged to relinquish* the formulæ derived from the expansion of alcohol for the whole 80 degrees of Deluc's scale, and calculate separately the positive or negative temperatures by that scale, and yet the remarkable fact is, that the principle deduced from Blagden and Gilpin's small range of 68 deg Fahr. coincide to every decimal when applied to Dalton's range of 180 degrees.

The tube of which the thermometer is to be blown, is assumed, as will at once be understood from the construction of the instrument, to have a perfectly equable bore, so that equal lengths may indicate equal expansion. This may be proved by causing a column of an inch or two of mercury to pass through the tube, the length occupied by which ought to be the same in every part, and those rejected which are not nearly so; at the same time it were to be desired that instead of aiming at a mere approximation to this accuracy, instrument makers would more frequently proportion the degrees of standard instruments to the absolute capacities of different portions of the tube. As the least moisture retards the accuracy of the motion of mercury, and prevents it from occupying the space with nicety, tubes as soon as formed should be sealed at the ends and not opened until they are to be made use of; the operation, too, of drawing the mercury into the tube for measurement, and of blowing the bulb, should by no means be performed with the mouth, but by an elastic caoutchouc bottle fixed to one extremity of the tube, and having a valve in its side. Tubes are sometimes made with a bore not circular but elliptical, or rather formed like the section of a double convex lens, by which means the height of the mercury becomes easily visible, whilst the area of the bore is no larger than that of a minute circular one, an advantage of no trifling degree, for the difficulty of inspecting the indications of a minute capillary thermometer causes an approach of the body, the heat of which affects surprisingly the accuracy of nice experiments. This we have constantly noticed in observing the sympiesometer, the capillary thermometer of which ought always to be first observed, as the approximation of the person of the observer, while making the adjustment of the column of oil, seldom fails, notwithstanding the nicest care, to raise the indications of the mercurial bulb, which is nearer the breath of the observer than that of gas, a considerable fraction of a degree.

The proportional adjustment of the diameter of the bulb to that of the bore of the instrument and the proposed size of the degrees, it is a matter of long practice to acquire; it may however be advisable to show the nature of these relations as a matter of theoretical importance, and of occasional utility in abstract reasoning on the subject. Some complex formulæ have, we find, been long since proposed by M. Durand, but we venture to give the following, which we have lately contrived, as being, so far as we know, original, and by far the simplest yet suggested; it will be seen that their demonstration is perfectly elementary, yet mathematically accurate.

Put the diameter of the bulb - - - $= a$.
The ratio of the diam. of the bulb to that of the bore - - - - - - $= b$.
Hence the internal diameter of the tube $= \frac{a}{b}$.
The measure of 1° F. in length - - $= x$.
The ratio of the circumference to the diameter - - - - - - $= \pi$.
The apparent dilatation of mercury for 1° F. in fractional parts of its bulk when contracted so as just to fill the bulb - - - - - $= \frac{1}{c}$.

Then will $x = \frac{2\,ab^2}{3\,c}$ and $b = \sqrt{\frac{3\,xc}{2\,a}}$.

For the capacity of the bulb is evidently expressed by $\frac{\pi\,a^3}{6}$ and the space occupied by 1° in the tube by $\left(\frac{a}{b}\right)^2 \times \frac{\pi x}{4}$, whence; $\frac{\pi\,a^3}{6\,c} = \left(\frac{a}{b}\right)^2 \times \frac{\pi x}{4}$.

$$\text{And } x = \frac{\pi\,a^3}{6c \times \frac{\pi}{4} \times \left(\frac{a}{b}\right)^2} = \frac{2\,ab^2}{3\,c}$$

From which we have, $b^2 = \frac{3\,xc}{2\,a}$ and $b = \sqrt{\frac{3\,xc}{2\,a}}$

Now, to find $\frac{1}{c}$ will be rendered very simple by the following considerations. Biot has shown,[*] that calling the apparent dilatation of mercury in glass, for any temperature t; $\triangle_t$; the true dilatation of mercury δ_t, and the cubic expansion of glass for 1° F., K, we have $\triangle_t = \delta_t - \mathrm{K}\,t$.

If, therefore, we substitute the latest results of Petit and Dulong for the temperature of melting ice and putting $t = 1°$ F.

$$\triangle = \frac{1}{9990} - \frac{1}{66960}\,.$$

The 9990 parts at 32°, would be 10000 at 42°, hence as far as regards the true expansion of the mercury we have only to diminish the denominator of the fraction by as many unities as the first degree of the scale close to the bulb is below 32°; and the corrected number will express the dilatation for 1 F. in fractional parts of the capacity of the bulb. It must, however, be farther corrected for the increased size of the glass, the cubical expansion of which may be taken at $\frac{1}{7}$th of that of mercury without an error nearly equalling the necessary defects of experiment, and that arising from different materials; we therefore arrive at this simple rule to find the expression for $\frac{1}{c}$. The degrees at which the stem of the thermometer commences being denoted by h,

$$c = \frac{8}{7}\left(10000 - \frac{6}{7}(42 - h).\right)$$

To give one example of these formulæ, "a thermometer having a bulb of which the interior measure is 0.25 inches, and the diameter of the bore 0.01 inches, the scale at the bottom of the tube at 0° F.; what is the length of one degree of Fahrenheit?"

$$\text{Here } \frac{1}{c} = \frac{1}{\frac{8}{7}\left(10000 - \frac{6}{7}(42 - o)\right)} = \frac{1}{\frac{8}{7}\left(10000 - 36\right)}$$

[†] Traité de Physique, i. 211.

$=\frac{1}{11387}$. Also having $b = 25$, $x = \frac{2 \times .25 \times 25^2}{3 \times 11387}$ $= \frac{312.5}{34161} = .009148$ inches to 1° F. The diameter of minute bores may be easily determined from the weight of mercury required to fill a certain length. For as tubes vary in capacity as the squares of their diameters, and as one inch in length of a tube an inch in diameter contains 2700 grains of mercury, we may use this proportion; as 2700 : 1^2 : : the weight of one inch of mercury in the given tube: the square of its diameter in parts of an inch. The application of very minute bores to alcohol thermometers, especially when a thread of mercury is introduced as in the instrument proposed by the Chevalier Landriani,* we consider as inapplicable in practice.

The form of the bulb of thermometers has varied according to their applications. Most frequently they are spherical, as at Plate DXXIV, Fig. 8., or elongated as Figs. 9 and 10, a form much to be commended as promoting an equilibrium of temperature through the mercury. So far indeed was this carried in former times, when from the size of the tubes the bulbs were necessarily so very large, that they were made extremely long and coiled up, as shown at Fig. 11, a form which we have often seen adopted both in France and Italy, as in the latter country, flattened bores seem quite unknown. To form the bulb, after the elastic bottle already mentioned has been attached, the other extremity of the tube is heated to fusion and then pressed flat by a piece of metal. The button thus formed is then raised to a white heat and kept constantly turning to prevent it from falling aside; by the action of the bottle the bulb is blown, but is repeatedly returned to the lamp till the requisite thinness is obtained, and the desired shape may then be given it, if it is to differ from the spherical; in addition to those already noticed, we may mention the lenticular, which is well fitted for exposing a large surface to the surrounding medium. It was proposed so long ago as by Drebbel, and is still imitated in Italy.

The next operation is to fill the tube, which is commenced by expelling a portion of the air by heat, and immersing the open end in clean mercury, which ought to be recently distilled; when a considerable quantity has thus entered the bulb, a paper cylinder should be formed by rolling a slip round the end of the tube, into which some mercury being placed, the contents of the half filled bulb are to be brought to a state of ebullition, and the vapour occupying the empty space, on condensing, the mercury will descend from the paper cylinder with rapidity and fill the instrument. Where considerable nicety is required, the mercury should be boiled carefully and repeatedly in the bulb and tube to expel all moisture and particles of air, during which operation it will be prevented from escaping by the upper receptacle already mentioned. When completely filled, enough of mercury may be expelled from the top to render its height convenient, and the length of the tube must be proportioned to its entire range.

The tube must next be hermetically sealed, in doing which, if a vacuum above the mercury be desired, the termination of the tube being brought to a capillary orifice, the bulb must be heated till a few drops of mercury are in the act of escaping, when the flame of a lamp must be suddenly directed so as to close the communication with the atmosphere. With these precautions, and if the thermometer has throughout been well made, the mercury will run up from the bulb when reversed, even in very fine tubes, unless they have the last degree of capillarity. How far the accuracy of this vacuum is a matter of importance or even of benefit, has lately been questioned, and indeed vague notions seem to have prevailed regarding the *resistance* which the inclosed air offers to the motion of the mercury in expanding. It lately occurred to the author of this article, that considering the enormous effort of fluids to expand almost any degree of pressure which the glass of a thermometer can sustain, could have no effect in this way; but only perhaps a small one by dilating the glass of the bulb, which might have the effect of lowering the surface of the fluid. To ascertain this point, which seems not before to have been practically examined, the following experiment was made. Three thermometers without scales were procured, perfectly similar in size and structure, with flat tubes and small bulbs, two of which were sealed *in vacuo*, and the third was sealed, having the upper part of the tube filled with air at the temperature of 62°. All three were plunged in this state into ice cold water and afterwards into several warmer mixtures, and the most regular of the two vacuum thermometers was chosen for careful comparison. Several points were accurately marked with waxed thread, and being plunged into water, which by a suitable contrivance was kept very steady in temperature, it was compared with the instrument in which air was sealed, and on the tube of the latter minute file marks were made at the various points. The extremity of the tube of the latter was then broke off, and by a new comparison other marks were made, the results of which are shown in the following table:

Vacuum Thermom	Pressure in the first case.	Pressure in the second case.	Diff.	Observed error for variation of pressure
32°	0.7 Atm.	1 Atm.	−0 3	0.[illegible]0
63°	1.0	1	+0	0. 0
80°	1.3	1	+0.3	0. 5
100°	1.9	1	+0.9	0. 6
120°	3 3	1	+2 3	0. 7

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* Brande's Journal, vii. 183.

The first column shows the temperature indicated by the correct standard; the second the pressure in atmospheres computed from the reduction of space in which the air was confined, counting the upper limit of the tube = 145°, and hence the bulk of 83° (or 145—62) corresponding to one atmosphere. The third column marks the constant pressure to which the mercury was exposed after the end of the tube was broke; the fourth, the difference of pressure in the two cases; and the fifth, the errors of the thermometer corresponding to these. The last numbers, however, must be considered merely approximations, from the smallness of the degrees on the instruments employed; however, they sufficiently prove that the effect of any *minute* quantity of air left in the tubes must be wholly insensible.[*]

The vacuum which has generally been left above mercury is supposed to be the cause of an irregularity observed in old thermometers, their indications being somewhat too high. This inquiry, a few years ago, produced several series of experiments by different observers, the discordance of whose results seems to have prevented the final settlement of the question. M. Flaugergues[†] attributed the rise of *nine-tenths* of a degree which he observed in the freezing point of thermometers, to the atmospheric pressure on the exterior of the bulb, as did MM. De la Rive and Marcet of Geneva, who recommended, that the upper end of thermometers should be left open.[‡] Bellani of Milan,[§] however, denies that this precaution has the desired effect, and imputes the alteration to molecular action in the parts of the glass, and to the time which that rigid material takes to assume its final form after the operation of blowing. M. Arago,[||] attributes the alteration to the escape of particles of air from between the mercury and the glass. Professor Moll[¶] doubts the existence of the alleged rise at all; we think, however, it has been satisfactorily proved by a great number of comparisons, though we know not if it has been suggested that some of these errors might be explained by the use of freezing water instead of melting ice in graduation, which was common in the last century, and which usually gives a temperature somewhat lower than the melting ice. Perhaps the most unequivocal proofs of the fact are those given by Mr. Daniell, in his excellent *Meteorological Essays*, who examined two thermometers made in the last century by Mr. Cavendish, who had graduated them only a little above and below the freezing point, and made the degrees very large; in one of these the freezing point had risen 0.°4, and in the other 0.°35.[**] Should the pressure of the air be proved to be the final cause, we should prefer inclosing a little air in the tube to act as a counterpoise, to leaving the extremity open which would admit moisture and injure the delicacy of the instrument.

When the thermometer is sealed it must next be graduated; the materials used for scales are various, and of these, perhaps, ivory is the best: metal scales injure the delicacy of the instrument by their high conducting power. Perhaps the best of all is that engraved on the tube, which is sometimes done in chemical thermometers. We have already discussed the fixed points of thermometers, but we must here say a few words upon the precautions in using that of boiling water, requiring an equation, to which we have alluded in a former part of this article.

From various causes, the precise temperature of boiling water may be subject to considerable variation, for instance, from the nature of the vessel employed, Gay Lussac having found[††] that while water in a metallic vessel vaporizes at 212°, it will sustain a heat of 214° or even 216° in one of glass. It was with great judgment, therefore, that the Royal Society of London, about the middle of the last century, appointed a committee, at the head of which was Mr. Cavendish, to investigate the fixed points of thermometers, and their elaborate report published in the Philosophical Transactions[‡‡] seems calculated to put to rest all further doubts on the subject. They recommend a tall vessel of tin plate, with a tight cover, having two apertures, one through which the thermometer is introduced, and fitted by a pierced cork; the other to which a chimney is affixed, two or three inches long, for the escape of steam, and over which a thin piece of metal is laid to act as a valve to prevent its too rapid escape. The thermometer is recommended to be suspended in steam a little above the surface of the water, it is therefore necessary that the steam should be kept of uniform tension. Fahrenheit first observed about 1724 the effect of atmospheric pressure on the boiling points of liquids, which rendered it necessary to graduate thermometers at a fixed state of the barometer, which ought to be 29.50, when the temperature of the water is taken and 29.80 when that of the steam. Deluc afterwards investigated the laws of this variation, and his formula for the equation of it, reduced to English measures, is the following:

$$h = \frac{99}{8990000} . \log . z - 92.804.$$

Where h denotes the temperature of the boiling point above the freezing point, in degrees of Fahrenheit, and z, the height of the barometer in tenths of an inch. As the logarithms here used are those of Briggs, in which all the figures are considered as integers, and containing seven places besides the indices, the formula in the common logarithms is thus expressed :

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[*] As it was only the general fact which was desired to be ascertained, we have not thought it necessary here to inquire more particularly into the causes or precise magnitudes of the differences observed; indeed it would have been superfluous with the means employed to have attempted greater accuracy, since a tenth of a degree was hardly perceptible. We are convinced, however, that the difference under the two cases of observation did not exceed that quantity either at 32° or at 63°, the latter observation being twice repeated with the nicest accuracy. It is, however, rather remarkable that the defect at higher temperatures appears in no respect proportional to the pressure sustained.

[†] Bibliotheque Universelle, xx. 117: xxi. 252.

[§] Giornale di Fisica, tom. 5.

[¶] Edinburgh Philosophical Journal, ix. 196.

[††] Ann. de Chimie, vii. 308, and Brande's Journ. v. 361.

[‡] Bib. Universelle, Avr. 1823, and Edin. Phil. Journ. ix. 391.

[||] Annales de Chemie, tom. xxxii.

[**] Meteorological Essays, p. 369.

[‡‡] Vol. lxvii.

$$h = \frac{99000}{899} . \log. z - 92.804.$$

The following Table shows the equation of the boiling point thus derived, and also the later numbers of Sir George Shuckburgh, which differ but little from those of Deluc.

Barometer.	Shuckburgh.	Diff.	Deluc.	Diff.
26.0	—7°.09	.91	—6°.83	.90
26.5	— 6.18	.91	— 5.93	.89
27.0	— 5.27	.90	— 5.04	.88
27.5	— 4.37	.89	— 4.16	.87
28.0	— 3.48	.89	— 3.31	.86
28.5	— 2.59	.87	— 2.45	.83
29.0	— 1.72	.87	— 1.62	.82
29.5	— 0.85	.85	— 0.80	.80
30.0	0.00	.85	0.00	.79
30.5	+ 0.85	.84	+ 0.79	.78
31.0	+ 1.69		+ 1.57	

The numbers refer to the temperature of the water, that of steam is about 0°.4 lower.

Upon the principle suggested by this table of measuring the pressure of atmosphere by the thermometer, Cavallo (though Fahrenheit had before hinted at it) proposed his thermometrical barometer, in the execution of which, several practical difficulties occurred till they were overcome by the Rev. Mr. Wollaston, who has more lately constructed a very elegant instrument on this principle.* It consists of a bulb *a*, Plate DXXIV. Fig. 12, one inch in diameter, the tube of which *d c* contains a few degrees near the boiling point, of such a length, that in the most delicate instruments, each of them admits of a division into 1000 parts by means of a scale *e f* with a vernier ; one of these parts corresponds to a difference of level of *six inches*. When in use, the thermometer is placed as shown in the figure in the cistern A containing water, which is made to boil by means of the spirit lamp B. When the observation is finished, the mercury contracts into the dilated part of the tube *b*, and being then inverted into the cistern and fixed by the screwing plate *g g* into which the stem of the thermometer is secured, a cap being screwed over the bulb which is then exposed, the instrument becomes extremely portable, the boiler being only 5.5 inches deep, and 1.2 in diameter. In order to shorten the tube without diminishing the range or the sensibility, a cap *c* is added by which some of the mercury may be expelled from the tube, or united to the column if the heights are great, and the depression likely to be considerable. A steam-pipe is employed similarly to the instrument of the Royal Society's Committee above described. The principal defect of Mr. Wollaston's thermometer is its liability to breakage in carriage, on account of the great weight of the large mercurial bulb. We are disposed to think that some fluid, such as sulphuric acid, which has a moderate specific gravity, and boils at a very high temperature, might, by being substituted for mercury, obviate this defect; any small inequalities of expansion (if such exist) would be quite insensible in so small a range.

We shall now describe as concisely as possible the principal modifications of the simple thermometer ; the most interesting of these are termed *self-registering*, which by inspection denote the greatest heat or cold which has occurred since the last observation, or else are employed to note the temperature at any moment in the absence of the observer. Of the former kind, the first which deserves notice, though Bernouilli seems to have the merit of originating the idea, is the thermometer of Lord Charles Cavendish.† For the maximum, he employed a mercurial thermometer, A *b*, Fig. 13, in which the temperature at the time of observation was indicated by the height of the mercury at C, while resting upon it was a column of alcohol which filled the tube. The termination of the bore was capillary, and covered by a glass receptable *b*, into which the capillary termination projected about two-thirds of the depth of the cap. By a rise of temperature, the mercury forces a portion of the spirits over the extremity of the tube, and as it cools, sinks without the possibility of the column of spirit carrying back what was expelled; the empty space of the tube, therefore, indicates the excess of the highest temperature since the last observation, above that indicated by the actual height of the mercury. It is adjusted by reversing the instrument and heating the bulb with the hand till the column unites with the spirit in the cap *b*, when the termination of the tube being covered, in this position it is allowed to cool, and the column is again made continuous. There are two defects in this instrument, the time required to assume the temperature of the air in the adjustment, which is obviously necessary, and that when in a reversed position and contracting, the mercury allows some of the spirit to pass it. We have found it useful in employing this thermometer to cool the bulb by means of ether, more speedily than it would otherwise have done to the temperature of the air. The minimum thermometer of the same philosopher was far more complex, and we suspect nearly impracticable. Its principle is represented at Plate DXXIV. Fig. 14, where the bulb A is filled with spirit, and also the bulb B, except a small portion of the mercury in the bottom, a column of mercury commences in the leg of the syphon *a b*, and indicates the temperature by its height at C. As the temperature declines, the mercury at *b* is drawn up into the bulb B into which it is intended to trickle by minute drops, the neck of communication *a* having a fine glass thread within it; a plan ingenious in theory, but we fear almost unattainable for practical purposes of adjustment, more especially as when it was to be prepared for a new observation, it was expected that on being inclined, the mercury would trickle back through *a*, and passing the spirits which had occupied it, reunite with its own column, a supposition rather startling to those who are acquainted with the motions of mercury and spirit.

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* Phil. Trans. 1817, p. 184.

† Phil. Trans. 1757.

A modification of Lord Charles Cavendish's thermometers, combining both a maximum and minimum register, in which the contrivance for the latter is greatly simplified, has recently been proposed by Mr. Forbes,[*] and a figure of it is given at Fig. 15, where *a* is the bulb filled with spirits, and having a little mercury in the bottom, being of the peculiar form there represented. The tube which terminates with it in a capillary orifice *c* is filled with mercury as far as *h*, which marks upon a scale the true temperature of the moment: above the mercury is a column of spirit, which by means of a capillary orifice, and cover *d*, indicates the maximum as in the thermometer just described. The portion of the tube *ef*, which is filled with spirit at any observation, of course indicates the quantity of mercury expelled into the bulb, and consequently by the application of a scale, the greatest depression of temperature. The instrument is adjusted by reversing it, when the spirit will cover the upper orifice, and the mercury the lower one; the hand is applied to the bulb till the spirit column is joined, and ether is then poured upon it till the mercurial column is brought in contact with the magazine in the bulb, the hand may be again employed to raise the temperature to that of the air as previously observed by the height *h*. By this means the instrument will be much quicker adjusted than even in Lord C. Cavendish's maximum, for which also we have found it advisable to use ether to reduce it quickly by the actual temperature. Notwithstanding the immense superiority in the simplicity of this instrument to the minimum one above described, we suspect from some attempts we have made on the subject, that there are almost insupportable practical obstacles to the satisfactory or general use of this thermometer, however accurate it may be in theory.

The thermometer which succeeded those of Cavendish was that of Mr. Six, described in the Philosophical Transactions for 1782.[†] It is represented in Fig. 16, where *a* represents an elongated bulb filled with spirit, which is continued through the curve *b* down to *h*, where mercury begins, and occupying the lower bend of the tube, reaches up to *i*, where the spirit recommences, and partly fills the expansion of the tube *c*, so as to give it space for its enlarged bulk when the temperature of the bulb *a* is raised. Placed within the spirit above its contact with the mercury are the two indices *e*, *f*, which are composed of steel coated with glass, and terminated with a dot of enamel on each end; to prevent them moving through the spirit by their own weight, a spring of glass was attached to them, for which now a bristle is more generally employed. It is obvious that, by the motion of the mercurial column as the spirit in the bulb contracts and expands, the indices will be left in the tube at different heights *e* and *f*, the indications of which are ascertained by two scales shown in the figure, the one of which is of course numbered downwards, the other upwards. The adjustment is made by means of a magnet, which brings down the indices into contact with the mercurial column.

This instrument, it will be observed, is not a little complex in its parts, having two contacts of spirit and mercury, and two indices, all which are detrimental to the practical accuracy of the thermometer. On this account the instrument has usually been made on a large scale, to prevent derangement in working; Mr. Six made the bulb no less than *sixteen inches* long, and *half an inch* diameter, while the tube had a bore of $\frac{1}{20}$ inch. But this enormously clumsy instrument had from its size still greater defects for any delicate purposes, and has since been much reduced; an instrument of this description, which we used almost constantly for nearly two years, made by one of the best London makers, had a bulb of only six inches in length. Yet we cannot help noticing the extremely slovenly manner in which all register thermometers are still made. The very instrument just mentioned had a tube of large bore, and two indices more than three quarters of an inch long, where half that size would certainly have been much better, and was farther mounted on a clumsy scale of boxwood, so that we confess it always surprised us that the instrument should act so well as it did. We observed sometimes a liability in the mercury to change its position in the column of spirits, which made the two ends not always point to the same degree on the opposite scales, a defect to which the varying length of the column of mercury itself, by great extremes of temperature, may also contribute.[‡] The indices are likewise liable to go wrong, and one of them constantly required the use of a very powerful horse shoe magnet after it had been for a short time in use. Were Six's thermometer, however, made with all the care and delicacy of which it is susceptible, it might, we have no doubt, be rendered an excellent instrument. It is perhaps better fitted than any yet contrived to measure the temperature of considerable depths of the ocean,[*] and likewise to investigate the decrease of heat in the higher regions of the atmosphere when applied to balloons.[†]

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[*] Dr. Brewster's Journal of Science, No. XIX. Jan. 1829, p. 159.

[†] Vol. lxxii. p. 72.

[‡] Six's self-registering thermometer is a spirit of wine thermometer, the mercury serving only to float the indices. This instrument, as now made by Carey, Jones, and other meteorological instrument makers, is of more convenient dimensions than that mentioned by Dr. Brewster. By information derived from gentlemen well acquainted with this instrument, and who have had ample opportunities of comparing it with others of similar design, it is believed to be the best and most correct of any of the self-registering thermometers now in use. It is, however, liable to the general objection against all spirit thermometers for high temperatures. The irregularity remarked by Dr. Brewster as respects pointing to the same degree of heat on the opposite scales, often arises from the position of the observer, who, in place of looking horizontally on both lines of mercury, looks down upon one and up to the other; this will make with each in appearance the difference of half a degree or more from the real height, occasioning an apparent difference of more than a degree between the two lines. As in all other thermometers, it must be made with a careful regard to the uniformity of the bore of the several bendings of the instrument. Six's son published in 1794 an excellent posthumous work of his father's on the construction and use of a thermometer for showing extremes of temperature in the atmosphere during the observer's absence, with experiments on the variations of local heats, &c. &c.—*Editor Am. Ed.*

A register thermometer by Dr. John Rutherford, is described in the Edinburgh Transactions,[‡] which, at least for the minimum, is decidedly superior to any other. That for showing the lowest temperature is shown at Plate DXXV. Fig. 1. It is a spirit thermometer, in the fluid of which is placed a little thread of enamel enlarged to a globule at each end seen at *a*, and this constitutes the whole instrument. From the cohesive power of the spirit confined within the tube, it does not suffer this little index to pass it without a very considerable shock; it therefore carries it back to the lowest point of contraction and there leaves it, marking the greatest cold, and by expansion the index is not carried forward. It is adjusted merely by inverting the instrument till the index runs down to the end of the column of spirit, where it stops. It is then laid in a horizontal position. The maximum thermometer, Fig. 2. is exactly the reverse of this, the index A being pushed forward by a column of mercury, and left at the point of greatest expansion. The index was originally of ivory, but from the friction with the interior of the empty tube, it was found advisable to make it of steel and adjust it with a magnet like Six's. Even this, however, does not prevent the index from getting entangled with the mercury, and Mr. Adie of Edinburgh has more recently adopted the plan of placing naphtha above the mercury, in which the index floats. This has somewhat altered the character of the instrument for simplicity, though we suspect it to be almost a necessary evil. The minimum thermometer, as we have already said, is almost unexceptionable; we have had long experience of it, and find it extremely little liable to go out of order. It is not yet, however, constructed with all the delicacy of which it is undoubtedly susceptible.

A contrivance, intermediate between Six's and Rutherford's has been more lately proposed by Dr. Traill. It is the minimum thermometer of Rutherford, with a short piece of mercury A (Fig. 3.) introduced above the index *a*, and the spirit again covering the mercury contains another index *b*. It is manifest that the mercury, by pushing back and forward these indices, marks the two extremes; being of steel, gilded by means of galvanism, they are brought back by the magnet. To this elegant instrument, we fear from the trials we have made, that there are likely to be strong objections; we have not merely found the mercury extremely liable to separate, but there is reason to fear, from the certainty that a film of spirit lines the whole interior of the tube, that by the efforts of its corpuscular attraction, and the difficulty of moving a sluggish column of mercury, however short, the position of the mercury, and consequently the true values of the degrees, will be changed.

Mr. Keith of Ravelstone[§] has described a thermometer which, by a mechanical contrivance, registers for any given time, in a continuous form, the flux of atmospheric temperature. His instrument has the form represented in Fig. 4. the bulb A down to the point is filled with spirit, where mercury commences, which is continued up to the point *h* in the opposite leg. It bears a float, which by means of a marker *b*, indicates the temperature upon a scale affixed, and by a mechanical contrivance, leaves indices at the extreme points. By the adaptation of a pencil to the marker, and of a rotatory cylinder moved by clock work, in place of the scale, it is obvious that the atmospheric changes will be transferred to it for every instant of time. This mechanical invention is very elegant, but has never met with, and is not calculated for, general adoption. Such mechanically drawn charts might please the eye or the fancy of the general observer, but we think we may lay it down as a maxim in meteorological science, that little is to be done in the present state of its advancement, by any mere mechanical contrivances not of the simplest possible nature, or which extend beyond the limits of a glass tube hermetically sealed.

Le Chevalier[||] has proposed lately a plan of registration sufficiently simple in its idea, and which had long since occurred to us. It is the adaptation of an index to the metallic thermometers which have been described in another part of this article. The difficulty, however, is to find a method sufficiently delicate not to impede the motion of these most susceptible instruments. No plan has been given for this.

We have already mentioned that, besides the registration of the greatest heat and cold, thermometers have been proposed to record the temperature at any given epoch. Mr. Keith's, as we have seen, answers this purpose, but one more specifically for this end has been proposed by Mr. H. H. Blackadder.[¶] He has a thermometer A. Fig. 5. constructed exactly similarly to Cavendish's maximum,[**] only that it contains mercury alone, and breaking the termination sharply over, fixes it into the case *b* without bringing it to a capillary termination, which we think a manifest defect. When held with the bulb A lowest, the column of mercury may obviously be made continuous; but if by a piece of clock-work the position be made horizontal, as shown in the figure, the column will be interrupted, and form a mark of the height of the mercury at that moment, when compared with the attached common thermometer B. But if the temperature were to rise after the given moment, the mercury would obviously be expelled from the end of the tube, to avoid which two hair pencils are contrived, at the moment of immersion, to drop an evaporable fluid on the bulbs, until they are observed, when by adding the degrees vacant in tube A*b*, to the height of the thermometer B, we have the temperature required for the given epoch. By terminating the tube of the thermometer A, in the manner shown in Fig. 6, it is obvious that the same effects will be obtained by a mere rotatory motion of the instrument, coinciding with the axis of the tube. We have not room to state our various objections to the instrument, but we conceive that the complexity of its construction, combining a double thermometer, a time-piece, and an evaporating apparatus, is such as to prevent its adoption beyond a very confined sphere.

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[*] Mr. Cavendish has given directions for applying corrections to register thermometers, on account of the immense pressure on their bulbs when in the sea, in Phipp's Voyage towards the North Pole.

[†] Dr. Brewster's Journal of Science, No. xv. p. 249.

[‡] Dr. Brewster's Journal of Science, vol. iii.

[§] Edinburgh Transactions, vol. iv.

[||] Bulletin des Sciences, Mars. 1829.

[¶] Edinburgh Transactions, x. 440.

[**] This gentleman, however, does not bring the termination to a capillary orifice, and merely applies a cap, cemented with Canada balsam, on the extremity of the tube. Perhaps he was told (as we have been) that it was impossible to do it otherwise. We have, however, had many thermometers made, of which the capillary termination, and soldered glass cap, was an appendage, with the greatest neatness, even on a very small scale, by an ingenious artist in Edinburgh.

So much for self-registering thermometers; we must now say a word or two on a modification of the common thermometer, in its most original form, which has been termed the *differential* thermometer. It is far from our intention to occupy our columns with any dispute regarding the true inventor of the instrument, which is exceedingly elementary in its principles, and is chiefly valuable from its applications. We will, however, say that we have examined the rare work of Professor Sturmius of Altdorff, entitled "*Collegium Experimentale Curiosum*," Nuremberg 1676, where the details and figures are so copious as to leave no doubt on the mind of the candid inquirer that Sturmius was the inventor of this modification of the thermometer. Professor Leslie and Count Rumford both revived it in 1804, under the titles of Differential Thermometer and Thermoscope, two forms of which are shown in Plate DXXV. Figs. 7 and 8. Its principle consists merely in showing the difference of temperature between two media, in which the balls A and B are placed, and these being filled with air, the excess of expansion of air in the one above the other is marked by the motion of the coloured fluid which fills the greater part of the bent stem, the height of which, *h*, is referred to a scale attached.

As it is strictly a thermometer of differences, it refers merely to the relative elasticities of the air in the two balls, and being hermetically sealed, is free from the common defects of the air thermometer.[*] The most important application of the differential thermometer to practical meteorology is the hygrometer invented by Mr. Leslie, on the Huttonian principle, of the difference between the temperature of a dry and moistened surface, a case exactly fitted for the interposition of the differential plan. We are happy to refer to a very elegant self-registering hygrometer on this principle, invented by the Reverend Mr. Gordon of Kinfauns, and described in the article METEOROLOGY, Vol. XIII. p. 167, in which the principle of Rutherford's minimum thermometer is elegantly applied to both the maximum and minimum indications of dryness. The differential thermometer has been made the basis of several other instruments by Professor Leslie, adapted to meteorology, but which have not come into general use, and which it would be beyond the object of this article to detail.

A new application of the simple thermometer has recently been proposed by Baron Fourier,[†] which he names a Thermometer of Contact. It is shown in Fig. 9, and consists of a bulb and tube AB filled with mercury, as usual. By means of a case CDEF, it is surrounded with mercury retained by a leather bag, *a b*, and being placed with the bottom resting on any substance *a*, whose conducting power is to be examined, the time of the descent of the temperature from a certain point to which it has been artificially raised, to that of the substance under experiment, expresses, by an inverse ratio, its conducting power, which it is the object of the instrument to determine.

The thermometric properties of bodies have been applied to various mechanical contrivances of great ingenuity. One or two, which may rather be considered new forms of the instrument, than any thing else, deserve a place here. Dr. Cummings of Chester proposed a statical thermometer, which, by being constructed on a large scale, might open and shut windows of rooms or hothouses as the temperature became elevated or depressed above or below any standard temperature. A similar idea occurred, we believe, many years ago, to one of our most original philosophers, Sir James Hall, Bart. who, in the course of his long series of admirable experiments, which required a steady and intense temperature for a considerable period, contrived a valve for his furnaces which by its own pyrometric action, was opened or closed as the temperature increased or declined. The instrument of Dr. Cummings consisted of a large glass or iron matrass filled with air, but containing mercury in its stem, which was inverted into a cistern containing the same fluid. The matrass was supported from above by a cord over a pulley connected with the sash of a window, nicely balanced by it, so that it will easily be seen how, when the weight of the counterpoise was diminished by the expulsion of mercury from the stem as the excluded air increased in volume by temperature, the sash was let down from the top, and a communication with the external air effected; the reverse of course taking place as the temperature declined.

The balance thermometer of Kewley is represented at Fig. 10. It consists of an elongated bulb of alcohol A, which fluid, in the expansion of the tube at B, is succeeded by mercury continuing along the tube *f f*, and has free motion in a receptacle at *c*. The whole being suspended from a frame *b c*, by the point *a*, to which knife edges are adjusted, it is manifest that the expansion of the alcohol will, by expelling part of the mercury from the bulb B into C, destroy the equilibrium of the machine, and the quantity of the deviation may be measured by the divisions on the brass scale *e*, moved by the pinion *a*, until the balance is restored. The machine, however, is most obviously applicable as a motive agent for mechanical purposes, such as the opening and shutting windows. Long before we were acquainted with Mr. Kewley's instrument, it occurred to us that such a contrivance would be applicable to the purposes of self-registration, but we believe it has never been put in practice.

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[*] A differential thermometer has been proposed by Mr. Howard, in which the differences of temperature are measured by the elasticity of vapour of alcohol in the two bulbs. See Brande's Journal, viii. 219.

[†] Annales de Chimie, Fevrier et Avril, 1828.

Such we consider to be a pretty full detail of all contrivances of merit for the improvement and modification of the thermometer. We have stated the principal disadvantages of each, as they occurred, generally from our own experience. Register thermometers are the most imperfect, and open the widest field for ingenious adaptations, yet when we consider the very numerous experiments that have been made, and the few attempts at novelty, which of late years have been practically successful, we are tempted to consider much farther improvement in the theory as vain. There are, however, very great desiderata in the workmanship of these instruments, and much also to be looked for from observers, and especially that the instruments should be more widely diffused. They are generally made too large, or, if smaller, act imperfectly. In common day and night thermometers the objection of size is comparatively unimportant, since the maximum and minimum points of temperature are usually sensibly stationary, till almost any instrument has had time to acquire it; yet, even for such observations, much improvement is requisite, and how much more for those more refined inquiries which demand great sensibility in the indication of maxima and minima in short intervals; more especially in exploring the temperature of the atmosphere by balloons, or in hourly observations of the highest and lowest temperature. The clumsiness of most register thermometers is by no means an inherent defect, as many would have us believe; by proper care and skill in the manufacture, they may be made of great fineness, even where indices are required. On the Cavendish plan of capillary terminations with reservoirs, there is in some cases no limit to the degree of tenuity: we have very recently had a thermometer for maximum temperatures made with mercury alone, and having an attached mercurial thermometer precisely similar, to ascertain the values of the height of the mercury, made on the most delicate scale, of which the thermometer may, in some sense, be said to be capable, so that the bore containing mercury is little more than visible to the eye, the length of the degrees being considerable, and the whole calculated for the nicest experiments; it appears to work extremely well. For general adoption, however, we are here disposed to recommend Rutherford's thermometer, except that they are ill suited for carriage, a defect applying also to all thermometers containing mixed fluids.

It is very fortunate for the science of meteorology that the simple mercurial thermometer has become, under the present mode of manufacture, perhaps the most satisfactory, complete, and simple of any of our philosophical apparatus. We admit the carelessness with which it is often made, and the want of agreement of instruments of the same construction which sometimes occurs; but we assert that this want of agreement has been overstated, and that the very backward state of this, the most elementary thermometric branch of meteorology, and the slow and doubtful steps which it even yet makes, is owing but very trivially to this cause, and almost entirely rests with the observers themselves. Most persons who observe the thermometer with even more than ordinary attention, are quite ignorant of the real difficulties in the practical use of the instrument, and how their labours may contribute best to the advancement of the science they wish to promote. In the most meagre register, the choice of hours, the accuracy to which they are kept, the position of the instrument, are all subjects of considerable difficulty, and requiring perseverance and practical knowledge; but should inquiries with the instrument be pushed beyond so meagre a diary, the consideration of time, and place, and affecting circumstances, whether remote or direct, rise to paramount importance, and if not duly attended to, destroy every value of such observations. Under the manifold difficulties of the subject, and the want of extensive and systematic co-operation under which so valuable an instrument as the simple thermometer, and the light which it throws on the state of the atmosphere, have so long laboured, we are disposed to think the most important foundation-stone ever laid for the science of meteorology, to be the series of hourly observations of the thermometer made at Leith Fort, under the direction of the Royal Society of Edinburgh, and at the instance of their late secretary Dr. Brewster, which was continued with unremitting vigilance for four years, 1824—27, and the results of the two first years of which have been published by Dr. Brewster, in a most important paper in the Edinburgh Transactions, Vol. X. The light there thrown upon the daily thermometric curve, renders it, we think, very well fitted for a brief notice in this place, being, as we have no hesitation in saying, far the most scientific tribute which has been paid to the value of the instrument. The horary thermometric curve for 1824 and 1825, is represented in Plate DXXV, Fig. 11, and it will easily be seen how nearly it approaches the form of a parabola. That it really does so, is shown by the following table,

Hour.	Observed.	Calculated for a parabola.	Difference.
8 h. 27′ P. M. Mean.	48.°266	48.266	0.000
9 - - - - -	47. 829	47.904	+ 0.075
10 - - - - -	47. 276	47.315	+ 0.039
11 - - - - -	46. 803	46.806	+ 0.003
12 - - - - -	46. 398	46.374	— 0.024
1 A. M. - - -	46. 134	46.021	— 0.113
2 - - - - -	45. 933	45.747	— 0.186
3 - - - - -	45. 689	45 551	— 0.138
4 - - - - -	45. 449	45.433	— 0.016
5 Min. - - -	45. 394	45.394	— 0.000
6 - - - - -	45. 653	45.555	— 0.098
7 - - - - -	46. 283	46.039	— 0.244
8 - - - - -	47. 029	46.845	— 0.184
9 - - - - -	48. 055	47.973	— 0 082
9 h. 13′ Mean. -	48. 266	48.266	0.000

Hour.	Observed.	Calculated for a parabola.	Difference
10 - - - - - -	49. 012	49.091	+ 0.079
11 - - - -	49. 050	49.969	+ 0.019
12 - - - - - -	50. 777	50.653	— 0 124
1 P. M. - - -	51. 149	51.141	— 0 008
2 - - - - - -	51. 470	51.434	— 0 036
3 Max. - - -	51. 532	51.532	0 000
4 - - - - - -	51. 239	51.422	+ 0.183
5 - - - - - -	50. 872	51 091	+ 0.219
6 - - - - - -	50. 294	50 514	+ 0.250
7 - - - - - -	49. 544	49.773	+ 0.229
8 - - - - - -	48. 624	48 783	+ 0 159
8 27′ - - - -	48. 266	48.266	0.000

where the difference never exceeds *a quarter of a degree of Fahrenheit.* In this paper, too, a complete solution is given of one of the greatest problems in the application of the thermometer to meteorology, the proper hour of observation; the mean temperature occurred in 1824 at 9 h. 13 m. A. M. and 8 h. 26 m. P. M.; in 1825 at 9 h. 13 m. A. M. and 8 h. 28 m. P. M., a most extraordinary coincidence, which sets the value of these tables in a true light, demonstrates the real accuracy attainable in the subject, and proves the value of *two* years of consistent and systematic observation, above the undigested mass of heterogeneous materials collected by the labours of single observers in a century. Dr. Brewster has given tables for reducing the observations for any hour of the day, or pair of hours, to the true mean, for which we must refer the reader to the paper itself, glad, however, of having had an opportunity of introducing to his attention so important a subject.

We propose now to give some hints for the application of the thermometer to practical meteorology, a subject, as we have just observed, most palpably neglected, and the importance of which has been so overlooked, that, as far as we know, nothing like a systematic set of experiments have been published on the influence of disturbing causes in the determination of atmospheric temperatures, nor has any attempt been made to classify these sources of error. In some of our most practical works, all directions on the subject are concentrated in such meagre terms, as "to avoid all kinds of radiation;" but unless observers have attended to the nature of these, the causes by which they are produced, and the extent of the error to which they may give rise, such general cautions are wholly vain. We have but to look at the absurd statements given in the meteorological contributions of ephemeral journalists, of preternaturally high temperatures alleged to have occurred in remarkable seasons; even the temperature of 100° and upwards, have often been stated as occurring in this country in the shade. We may cite the very extraordinary summer of 1826, as a striking example of this, and we may refer to a paper, on that occasion, in the Edinburgh Journal of Science for October of that year, as a specimen of the nice precautions requisite in ascertaining with accuracy such extraordinary temperatures. When the temperature of the air remains for any time above 80°, no attention can be too great to avoid errors of radiation and reflection. The great importance of the subject, the neglect it has received, and the absolute necessity of attending to it, to do the thermometer any justice as a meteorological instrument, induces us, before concluding this article, to give a bare outline of the subject, as one deserving of much attention in filling up.

The author of the present article has devoted some time and care to this inquiry, and particularly in the summer of 1828, made at his leisure some experiments connected with it, but without any immediate view of publication, and consequently without such systematic arrangements, and such a provision of apparatus as he would otherwise have adopted. During the present summer (1829) he intended to have continued these upon an enlarged and improved plan, but the extraordinary changeableness of the season, and an almost unremitting course of cloudy weather, deprived him of his best opportunities. He is therefore compelled to draw for illustration of his ideas upon his older sources of private information, of which, though upon an imperfect scale, he vouches for the accuracy, and they will aid him in pointing out at least what he conceives to be the track in which such an inquiry should be pursued.

The deviations of the thermometric results from the real temperature, are either from *internal* or *external* causes. The former arise from the inaptness of any index of expansion we can use to assume the identical temperature of the air at any moment. Upon these we mean not at present to dwell; they have already been partly discussed in a former part of this article, when alluding to the variable capacities of bodies for heat. Alcohol thermometers we have shown to be more sluggish in their impressions than mercurial ones, and air is more rapidly affected than either. Hence the most essential error of the Sympiesometer, an instrument already alluded to: its whole accuracy depending on the perfect coincidence of the indications of the gaseous and mercurial bulbs, a certainty of which in many cases it is very difficult to attain.* In observations where the change of temperature is rapid or considerable, the sluggishness of alcohol thermometers may sometimes be sensible; but in most cases it is not so, as will be shown by the accompanying table, in which case, however, circumstances were rather favourable, the wind being in an advantageous quarter for promoting an equilibrium, the exposure of the window, close to the sill of which both instruments were suspended, being N.N.W.

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* See Mr. Forbes's paper in Dr. Brewster's Journal for April 1829.

TABLE I.

1st August 1829. Wind N. W. rather brisk.		
Hour.	Merc.	Alc.
12h. 30m.	66	66
12.45	66	65.5
1.0	66	66
1.15	66.5	67
1.30	66	66
1.45	65	65
2.0	65	65
2.15	65.5	65.5
2.30	66	66
2.45	67	66.5

The various sizes of the bulbs of thermometers is another great cause of inequality, but which is easily reducible to a known law; for since all the particles of the substance *cæteris paribus* require equal times to acquire a new temperature, the sensibility will be inversely as the masses; but as such a change depends upon an equable effect produced by the extent of surface exposed to the acting medium, it will be directly as the surfaces. But as in spherical bulbs the surfaces vary as the squares of the diameters, but the mass as the cubes, the sensibility will be as the $\frac{2}{3}$ power of the diameter, that is, inversely as the diameter simply.

But external causes, or those independent of the expanding substance itself are more complex and diversified. They may perhaps be classified in the following way.

I. Radiation, *a* solar, *b* Terrestrial.
II. Reflection of heat by buildings and other objects.
III. Absorption. *a*, By the wall or object to which the thermometer is attached. *b*, By the scale and mounting. *c*, By the colours of neighbouring objects.
IV. Humidity. *a*, At the time of dew falling. *b*, By the proximity of water.

I. Of the existence and great force of radiation, both of heat from the sun impressing the thermometer, which interrupts the free passage of its rays, and elevates the temperature above that of the atmosphere, and of heat from the earth in cold nights, which by transmitting rays to distant points of a clear sky, when the equilibrium is disturbed by the absence of the sun—it is not our present object to speak—but both are sources of error in observations conducted for other purposes than to measure them. The direct action of the sun's rays upon the naked bulb of the thermometer is much smaller than many persons imagine, for so vast a portion is reflected by the brilliant polish of the mercurial bulb, that it requires to be blackened to indicate the true effect, by absorbing the luminous and calorific rays. We have often seen a thermometer very little influenced by the direct rays of the sun, if his altitude was not great, and there was a breeze of wind. From *direct* radiation it is unnecessary to warn the attention of the observer, it is by *reflection* and *absorption* that its influence is so difficult to be avoided. It is not merely in ascertaining great colds, as at night,* that the influence of terrestrial radiation is sensible. Even where more than half the sky is sheltered from the instrument, and in ordinary summer weather, its influence must be avoided. This will be illustrated by Table II. in which a large thermometer hung at a window, in the usual way, is compared with one having the scale detached and laid among cotton on the window sill exposed to the northern sky. The differences are very striking, and show how much errors are to be avoided in experiments, even at ordinary windows. We shall quote some other observations connected with terrestrial radiation, when we touch on the subject of Dew.

TABLE II.

August 25, 1828.		
Hour.	Shaded	Exposed.
11h. 0m.	62.4	56.5
11.30	63.0	57
12.30	64.0	59.75
1.0	65.2	61 —
1.30	66.0	61 +
2.0	67.6	61.5
2.30	69.2	64
3.15	71.0	66
3.30	70.0	65.5

II. Reflection.—In making observations in towns this is one of the greatest difficulties to be struggled with, since opposite houses, and the street below, never fail to reflect great quantities of extraneous heat, even in the best exposures. It is very frequently to be observed, that from the position of a thermometer in country houses, all the heat of the afternoon's sun is reflected from some projecting wall, yet the indications of the instrument are unsuspectingly observed to the last moment that the sun's rays do not touch the bulb. This is a fertile source of error to the amount of very many degrees, among ordinary observers—but in its more refined forms, *reflection* is an almost invincible obstacle, even with the greatest care—the sun's rays are reflected even from grass at great distances.† We have often seen thermometers hung at a north window, on the third floor from the ground, materially affected, in the middle of the day, by the sun's rays upon the grass, thirty feet below, and at a very considerable distance from the foot of the wall. The preventions of reflection are sufficiently simple in description, though very difficult to be obtained in practice. Double and independent coats of polished silver for the bulbs of thermometers have, we believe, been occasionally employed to resist radiation in all its forms; but where accurate experiments, on high temperatures, are to be made, we can recommend nothing equal to hanging the thermometer under the branches of a thick tree, abundantly surrounded by others; at a window little can be done when the air is not in a tolerable state of motion; pasteboard screens against particular reflecting objects, such as flat roofs, we have sometimes used, with advantage. Register thermometers are particularly liable to the effects of reflection, and all other disturbing causes in the indication of maximum temperatures, which has often caused us great inconvenience; polished copper cylinders, with free ventilation above and below, in which the instrument is placed, have been recommended for this purpose, particularly in tropical climates, where from the verticality of the sun, perfect shade is peculiarly difficult to be obtained. Reflection is so rarely separated from the influence of absorbed heat by surrounding objects, that the separation of them requires experiments peculiarly conducted, which, from the unparalleled unpropitiousness of the season, we regret not to have had an opportunity of completing. United with the effects of absorption, we shall presently give several examples. We have pleasure, however, in referring to the experiments of Captain Sabine and others, in Daniell's Meteorological Essays on this subject.

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* Such as in the remarkable experiments of Dr. Patrick Wilson of Glasgow. (Philosophical Transactions). See also many experiments in Wells's Essay on Dew, and Daniell's Meteorological Essays. For upwards of a year we have measured the maximum effect of radiation constantly, by a comparison of a register thermometer, freely exposed, and one sheltered and attached to a window. At all seasons we have observed great average differences. In June 1828 the *mean* amounted to 10°.26.

† See an example in the paper on the summer heat of 1826, in Brewster's Journal, October 1826.

III. The first kind of Absorption of heat we have to notice, is that by walls and other surrounding objects generally. Any extensive and fixed object in the vicinity of the thermometer, obviously tends to impart to it a constant share of heat, and subtract from it independent of the actual temperature of the air. The heat of an inhabited house is sufficient to influence considerably the indications of low temperatures made at the window. In the course of the diurnal rise of heat, the temperature of the mass of the building being lower, absorbs from the adjacent film of air, and the thermometer placed in it, a part of its heat. This cause, however, is generally not much felt, since the influence of reflection, or radiation, soon raises the temperature of the mass, which forming a receptacle for the accumulation of solar heat vaguely distributed through the atmosphere, rises, if its means of acquisition be considerable, to a temperature exceeding, by several degrees, the maximum in the shade, and as the diurnal temperature descends, the disproportionate slowness of the cooling of so great a mass, aided by new accessions of radiated heat, gives to the afternoon indications of the thermometer, a more than due height, a circumstance often of great inconvenience to the observers, especially as, in those seasons where considerable temperature becomes an object of scientific curiosity to measure, the sun's sweep in Azimuth in considerable latitudes, is so great as to make a series of observations at one station, during a considerable part of the day, very difficult, and still greater uncertainties are generally found in a new station; it will be found that the front of a building, towards the meridian, will, for several hours, after it has ceased to be affected with direct radiation, be unsuited by absorption for delicate experiments.

The following tables will illustrate generally the above remarks, and some other effects both of reflection and absorption. Observations on solar radiation by a thermometer covered with black cloth, and exposed on bare soil, are generally added, to indicate the state of the weather.

TABLE III.

August 25th, 1828.

Hour.	No. 1.	No. 2.	Diff.	No. 3.
10h.0′	61	90.5	29.5	
10.30	61	105	44	
11.0	61	110	49	62.4
11.30	63	115	52	63.0
12.0	*68	111	47	
12.30	*67.5	109	44	64.0
12.45	65.5	105	39.5	
1.0	65	104	39	65.2
1.30	64	95	31	66.0
2.0	64	82	18	67.6
2.30	63.5			69.2
3.15	65			71.0

Clouds after 12 o'clock.

* These observations were made at a different place.—The force of radiation in col. 4, is given by interpolating independent observations.

In Table III. No. 1, was a thermometer placed among thick trees in perfect shade. No. 2 was in the sun. No. 3 was a large thermometer hung at the east side of the airy and lofty north window already mentioned.

TABLE IV.

August 26th, 1828.

Hour.	No. 1.	No. 2.	No. 3.	No. 4.
10h.0′		72		
11.0	69.25	73	70.0	71.75
11.30	68.25	72	69.8	70.5
12.0	70	74	71.2	72
12.30	70	74	70.8	71.25
1.0	71	74	72.4	73
1.30		74	72.0	72.75
2.0	71.25	75	72.8	73.25
3.0	72	75	73.8	75
6.15	68.5	*71	*69.4	

* Exposed to bright horizontal sun.

In Table IV. No. 1, is a thermometer placed among trees in perfect shade. No. 2, a thermometer with metallic scale and glass case hung on a black painted pannel on the west side of a north window. No. 3, a large thermometer, mounted on metal, hung at the distance of one foot from the same window. No. 4, a small and delicate instrument, at two feet distance. It is worth observation that the reflection from grass at 30 feet below, was so considerable, that No. 4 always indicated a temperature higher than No. 3, which was much more liable, in every respect, to the effects of absorption. The last observation at 6h. 15′ is inserted in confirmation of a remark we have already made upon the small influence of direct radiation upon a naked bulb when the sun is low.

The more general effect of approximation to a building, is an increase of temperature by the absorption and subsequent communication of heat by that body. Hence, unless the causes of direct reflection are preponderant, as in the last Tables, the thermometer nearest the wall indicates the most elevated temperature, as illustrated by the following experiments.

TABLE V.

August 1st, 1829.			
Hour.	No. 1.	No. 2.	No. 3.
12h. 30′	66	65	65
12.45	66	65	65
1.0	66	66	66
1.15	66.5	65.5	65.5
1.30	66	65+	65.5
1.45	65	64.5	64.5
2.0	65	64.25	*64.25
2.15	65.5	65.5	66
2.30	66	64.5	65
2.45	67	65.5	66.5

* Sun just beyond No. 3.
† No. 3 partly in sunshine.

The three thermometers used were constructed for the purpose, of small size and flattened bores, with light paste-board scales attached. No. 1 hung freely at the window sill already mentioned. No. 2 at 1 ft. 3 in. from the wall, and No. 3 at 2½ ft. or double that distance. It will be observed that the height of No. 1 almost constantly exceeded that of the others by a less or greater quantity, but that the two last agreed perfectly till the shade of No. 3 was partially removed as the day advanced, a slight heat being communicated by the interruption of some of the rays by the frame to which the thermometers were attached; for the mere passage of the solar beams communicates no heat without the intervention of some object, and the direct distance of the grassy flat below, upon which they fell, was perhaps 40 feet. Had the day been unfavourable for the equilibrium of temperature, the differences would have been more considerable, but the wind being brisk from the N. W. diminished the sources of error. When the wind proceeds from points opposite to the sun at the hot part of the day, the instruments placed in the shade are of course most exposed to its influence, which often counterbalances all trifling causes; of course, in the N.E. point this reaches a maximum. The two following Tables will demonstrate its influence in annihilating the effect of absorption last illustrated, while they will show the constancy of the difference between observations made in contact with a building, and one defended from radiation in all its forms by the shelter of thick trees, the instruments being within not much exceeding 100 yards from each other. No. 1 was the large thermometer already mentioned, hung one foot from the window. No. 2 a small and delicate instrument at 2½ feet. No. 3 the accurate temperature of the shade under trees, and No. 4, the indications of a thermometer covered with black cloth in the sun. In Table VI. some observations on humidity by a moistened thermometer are added.

TABLE VI.

August 28th, 1828—Light Wind N. E.					
Hour.	No. 1.	No. 2.	No. 3	No. 4.	No. 5. moist.
11.15	72.4	72.5	72.25	104	
11.45	72.4		73.	104	
12.0	72.2	72.+			
12.45	71.6	71.5	70.25		66
2.0	72.3	72.75	70.75		65.5
3.0	74.2	74.5	72.5		66.5

TABLE VII.*

Aug. 29th, 1828.—Light Wind, N.E.				
Hour.	No. 1.	No. 2.	No. 3.	No. 4.
11.15			70.25	98
11.30			69.75	108
12.0	70.4	70.25	70.5	109
1.0	69.1	69+	68.5	104.5
2.0	70.4	70.5—	70.75	104
3.0	68.8	69—		

The second kind of absorption we have mentioned is caused by the scales and mounting of thermometers, which is often done in a very unskilful way, and in the measurement of high temperatures is as fertile a source of error as any other. Not merely do the scales of thermometers, when large, act as increasing the mass of matter to be heated or cooled, but, as we have already explained in the case of buildings, magnify the influence of radiation and reflection, by accumulating the calorific rays which find their way to the instrument; and if the scale be metal, as is frequently the case, its rapid conducting power facilitates the communication. This is our principal objection to metallic scales. The adoption of glass cases also, to protect the instrument from the effect of weather, is, to the last degree, prejudicial in retarding an equilibrium of temperature; the small hole at the bottom of such cases being a very tardy medium of communication. These remarks will be confirmed by the following table of the indications of three instruments, extremely differently mounted, and placed together at a free exposure at a window. The total effect of absorption will be seen by a comparison with a thermometer in absolute shade, No. 4.

TABLE VIII.

August 27th, 1828.				
Hour.	No. 1.	No. 2.	No. 3.	No.4.
12h.0′	73.8	74		71.5
1.15	75.8	76—	75.5	73.25
2.30	77.2	77.5	76.75	74.25
3.30	78.0	77	76.5	74.75
5.0				74

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* It is proper to mention, that in copying out these observations, we had some doubt as to the relative positions of Nos. 1 and 2 in Table VII. But from comparing them with the preceding day, and other circumstances, there seems to be no doubt that they were placed as there stated.

No. 1 was a large thermometer, by Adie, attached to the case of a sympiesometer, of considerable mass. No. 2, a thermometer by Jones, with a metal scale of the usual size. No. 3, a small and delicate one, with light ivory scale by Cary. These were all hung together. Nos. 1 and 2, by the superior conducting power of their scales, kept nearly together till the maximum, but at 3h. 30m. the effect of the mass of No. 1 becomes evident by keeping up the temperature, while No. 2, losing its heat with facility, speedily began to decline. Taking also into consideration the third modification of absorption, as connected with the colour of the object upon which the instrument is suspended, we present the following table; in which No. 1 is the instrument No. 2 of the last table, but inclosed in a glass cylinder, and hung against a pannel of wood painted black, at the west side of a north window. No. 2 is the thermometer of a sympiesometer, hung on the opposite pannel, exposed without cover to the N.W. wind. No. 3 is the thermometric indication of the gaseous bulb of the same instrument, which, as usual, is protected by a polished brass cylinder, but admitting free ventilation. It was used by correcting the instrument for *pressure* instead of *temperature*, as is done when we wish to extract the barometric indications. No. 4 was a small thermometer with detatched scale freely suspended at the window sill. The differences are sufficiently marked, but had the day been more sultry and perfectly free from clouds, (which sometimes intervened) they would have been more striking.

TABLE IX.

Aug 1st, 1829.—Wind Moderate N.W.									
Hour.	No. 1	No. 2	No. 3	No. 4	Hour.	No. 1	No. 2	No. 3	No. 4
12h. 30m.	69	66.4	66.4	66	1h. 45′	68	65.9	65.8	65
12.45	69 +	66.2	66.3	66	2.0	67.5	65.3	65.5	65
1.0	69.5	66.6	67.0	66	2.15	68.5	66.4	66.4	65.5
1.15	70 —	67.0	66.5	66.5	2.30	68	66.3	65.6	66
1.30	70	66.8	66.5	66	2.45	69	67.0	66.9	67

The following small table shows the remarkable continuance of the effect of absorption in a large building, especially when accumulated by a black surface, with which the instrument is in immediate contact.

TABLE X.

August 27th, 1828.			
Hour.	No. 1.	No. 2.	Diff.
8h. 30m. P.M.	66	62.8	3 +
8.45	65	62.1	3 —
9.30	64.5	62.7	2 —
10.0	63	62.6	0.4

No. 1 is in this situation, being the thermometer with a metallic scale, the same as No. 1 in the last table, placed, as there described, in a common glass cylinder, on a black pannel facing the east, at a north window. No. 2 is No. 2 of last table, and freely suspended for comparison, the observations commencing above an hour after sunset, and the differences regularly diminishing, and scarcely vanished after an hour and a half, a curious fact, showing the intrinsic difficulty of obtaining the temperature of the atmosphere by observations at any one spot. Another illustration will be found in Table IV.

IV. Humidity.—The first source of error, which we have classed rather from convenience than by strict theory under this head, includes the many irregularities which disturb the indications of the thermometer at the time of dew falling, a subject one of the deepest in meteorology, and which we merely introduced as one of the most important sources of error requiring to be thus scantily mentioned in this place. And we cannot help observing, that in the attempt to register faithfully the true atmospheric temperature for twenty-four hours in summer, the most difficult point of management is about sunset, when we are driven from the trees by the copious deposition of humidity, and temporary decline of local heat, to the alternative of a building, the whole of which is more or less affected by the absorbed heat of the preceding day.

TABLE XI.

August 27th, 1828.			
Hour.	No. 1.	No. 2	No. 3.
8h. 30m. P.M.	62.8	57.5	57.5
8.45	62.1	56.75	58
9.0		58	57
9.30	62.7	56.25	55.75
10.0	62.6	55.25	54.75

In Table XI., No. 1 was exposed in contact with the wall, at a window thirty feet from the ground. No. 2 was suspended four feet above the grass and free from buildings. No. 3 was laid on the grass and exposed to terrestrial radiation, which, according to the beautiful theory of Dr. Wells, is the original cause of dew. The difference between Nos. 1 and 3 here amounted to 8°.

TABLE XII.

August 28th, 1828.			
Hour.	No. 1.	No. 2.	No 3
7h. 30′	62.0		61 (?)
8.0	62.0	57.5	57.5
8.30	62.2	57	56.5
9.0		57	54
9.30	60.4	56	56
10.0	59.2	56	56.5
10.30	59.2	55	56.5

Table XII. is illustrative of the same facts, and the differences of the temperature of the grass; and the air four feet above it (the numbers being of exactly the same import as in the last table) are still more remarkable. But we have not room at present to enter into the consideration of these facts.

With regard to the proximity of water, the other source of humidity mentioned, we have nothing particular to add; the cold produced by the solution of water is well known to be subjected to certain hygrometric laws, and this influence communicates an absolute degree of cold to any film of air actually in contact with water. The proximity of the sea has besides a general influence on climate, by tending to flatten the form of the annual curve, its temperature diverging little from that corresponding to the latitude.

With these details, for the imperfection of which we have already apologised, we must conclude at present the subject of thermometric errors, and with them the present article. The meagre illustration we have been able to give of these remarks, show that abundant scope is given for extended researches upon a systematic plan, with the certainty of results of practical value, which ere this the author of the present article had hoped to have filled up, but at least we are convinced that we should not have done justice to the thermometer as an instrument, without some attempt to direct the observer in the practical use of it. Our limits do not permit us to enter more fully upon the means of preventing errors in practice, but the detail of the sources of these has almost formed a sufficient guide.

We here subjoin a very complete table of phenomena occurring at particular temperatures.*

Fah.	
— 90	Greatest cold produced by Mr. Walker.
— 55	Strongest nitric acid freezes (Cavendish).
— 50	Greatest natural cold observed at Hudson's Bay.
— 46	Ether and liquid ammonia freeze.
— 45.5	Nitric acid, specific gravity 1.424, freezes.
— 45	Sulphuric acid, specific gravity 1.6415, freezes.
— 39	Mercury freezes.
— 36	Sulphuric acid (Thomson).
— 30	Nitric acid, specific gravity 1.407.
— 23	Observed on the surface of snow at Glasgow, 1780.
— 22	Acetous acid freezes.
— 14	Observed at Glasgow, 1780.
— 11	2 alcohol 1 water freezes.
— 7	Brandy.
— 7	Snow and salt equal.
— 3	
0	
+ 1	Strongest sulphuric acid freezes (Cavendish).
4	1 common salt 3 water freezes.
7	1 common salt 4 water freezes.
8	Sal-ammoniac 4 water freezes.
16	Oil of turpentine freezes (Macquer).
20	Strong wines freeze.
23	Fluoric acid freezes.
	Oils, bergamot and cinnamon freeze.
25	Human blood freezes.
28	Vinegar freezes,
30	Milk freezes.
32	Water freezes.
36	Olive oil freezes.
40	Equal parts sulphur and phosphorus melt.
42	Sulphuric acid, specific gravity 1.741, freezes.
43	Phosphorus burns slowly.
46	Sulphuric acid, specific gravity 1.78, freezes (Keir).
50	Strong acetic acid freezes.
59	Vinous fermentation begins.
64	Oil of aniseeds, 50 (Thomson).
66	to 135, animal putrefaction.
75	to 80, summer heat in this climate.
80	Phosphorus burns in oxygen: 104 (Gottling).
82	Adipocire of muscle melts.
88	Acetification ceases.
96	Ether boils.
96	to 100, animal temperature.
97	Lard melts (Nicholson).
100	Phosphorus melts.
104	Resin of bile melts.
107	Feverish heat.
109	Myrtle wax melts (Cadet).
	Stearin from hog's lard melts.
112	Spermaceti melts (Bostock).
122	Phosphorus burns vividly (Fourcroy) 148 (Thomson).
126	Bisulphuret of carbon boils.
127	Tallow melts (Nicholson) 92 (Thomson).
140	Liquid ammonia boils.
145	Camphor sublimes (Venturi).
145	Ambergris melts (La Grange).
149	Bees wax melts.
150	Potassium melts.
155	Bleached wax melts (Nicholson).
165	Albumen coagulates 156 (Black).
170	Sulphur evaporates (Kirwan).
176	Alcohol boils, 174 (Black) 173 (specific gravity 800).
190	Sodium melts.
212	Water and most essential oils boil.
212	Bismuth, 5 parts, tin 3, lead 2, melt.
218	Sulphur melts (Thomson), 238 (Hope), 212 (Fourcroy), 185 (Kirwan).
219	Phosphorus distils (Pelletier).
225	Water saturated with common salt boils.
230	Muriate of lime boils (Dalton).
235	Adipocire of biliary calculi melts.
242	Nitrous acid boils (Fourcroy).
248	Nitric acid boils.
283	Tin and bismuth, equal parts, melt.
283	White arsenic sublimes.
303	Camphor melts.
303	Sulphur burns slowly.
316	Oil of turpentine boils (Ure).
334	Tin 3, lead 2, or tin 2, bismuth 1, melt.
442	Tin (Crichton) 413 (Irvine).
460	Tin 1, lead 4, melt.
476	Bismuth melts (Irvine).
540	Metallic arsenic sublimes.
554	Phosphorus boils.
570	Sulphur boils.
590	Sulphuric acid boils (Dalton), 546 (Black).
600	Linseed oil boils. Sulphur sublimes (Davy).
612	Lead melts (Crichton), 594 (Irvine), 540 (Newton).

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* Arranged from Henry's Chemistry, vol. ii.

Fah.	
635	Lowest heat of ignition of iron in the dark.
660	Mercury boils (Dalton), 644 (Secondat), 600 (Black), 672 (Irvine), 656 (Petit and Dulong).
680	Zinc melts (Davy), 698 (Brogniart).
800	Hydrogen burns, 100 (Thomson).
802	Charcoal burns (Thomson).
809	Antimony melts.
1050	Iron red in twilight.

For the higher or pyrometric temperatures we refer to the article Pyrometer, as likewise for the expansion of different substances.

On the subject of the Thermometer, the following works may be consulted:—Sanctorii *Commentaria in Avicennam. Saggi di Naturale Esperienze*, vol. i. Van Helmont *Opera;* Sturmius, *Collegium Naturale Curiosum*, Nuremburg 1666; Martine *on Thermometers;* Newton, *Principia;* Hooke, *Micrographia;* Boerhaave, *Chemiæ*, i. 720; De Luc, *Modifications de l'Atmosphere;* Leslie *on Heat;* Rumford's *Essays;* Crawford *on Animal Heat;* Dalton's *Essays;* Nicolson's *Chemistry;* Henry's *Chemistry*, vol. i. and Appendix to vol. ii.; Daniell's *Meteorological Essays;* Biot, *Traité de Physique*, vol. i.; Parry's *Second Voyage, Appendix.*

Boyle, Hook, Newton, Fahrenheit, Cavendish, Hutchins, Wilson, Six, Rumford, and others, in the *Philosophical Transactions;* Keith, Hope, Blackadder and Brewster, in the *Edinburgh Royal Society's Transactions;* Bouvard *on the Meteorological Observations made in the Observatory at Paris*, in the *Memoirs de l'Institut;* sundry papers in the *Journal of the Royal Institution;* Nicolson's *Journal; Edinburgh Philosophical Journal;* Dr. Brewster's *Journal; the Bulletin des Sciences; the Annales des Mines; the Annales de Chemie; the Bibliotheque Universelle; the Giornale de Fisica*, &c. &c.

See also the articles Atmospherical Clock, Chemistry, Heat, Meteorology, Pyrometer. And upon particular subjects, see the references in the course of the preceding paper. (△)

THERMOPYLÆ, Battle of, See Greece, Vol. X. p. 72.

THETFORD, a market town of England in Norfolkshire, situated at the confluence of the Little Ouse and Thet, the first of which flows through the town. It consists of several streets, the principal of which are in the form of a cross. In the time of Edward III. it received the name of *Hierapolis* and *Monachapolis*, from its having twenty churches and eight monasteries. At the same time, it had twenty-four streets and six hospitals. The principal buildings are three churches, St. Peter's, St. Cuthbert's, and St. Mary the less, the guildhall, a handsome market-house, a new bridge; a county gaol, a bridewell and workhouse. There is also here a free school, an hospital and several alms-houses. As the Little Ouse is navigable, Thetford enjoys considerable trade, exporting woollen goods, corn, malt, beer, paper, &c. There are three breweries in the town, a circulating library, and a printing office. The chief manufactures are woollen goods, malt, paper, wire tools, and agricultural machinery. Population of the burgh, in 1821, 579 houses, 703 families, and 2922 inhabitants. See *Beauties of England and Wales*, vol. xi. p. 241.

THIBET.

Thibet or *Tibet*, an extensive country of central Asia, is bounded on the south by the Birman Empire, Assam, Bootan, Sirinagur, and Hindostan: on the west by Great Buckharia; on the north by Eastern and Western Tartary; and on the east by China. These boundaries, particularly on the north and south-east, have not been exactly ascertained. On the north, there appears to be provinces, to which our geographical knowledge does not yet reach. The extent of this country must, of course, be a little uncertain; but its length from east to west has been estimated at 1500 miles: its breadth from north to south at 500.

Thibet, the name by which this extensive territory is known to us, is a term not much used in the country itself. It seems indeed to be known to different people under different names. The Chinese, for example, call it Dshan. The Mongols or inhabitants of Tartary term it Baran-tala. The natives themselves call it Püe or Puë Koachim—the word Püe signifying north, and Koachim, snow; terms, as we shall see, admirably descriptive of the country. (Captain Turner's *Account of an Embassy to the Court of Thibet in the year* 1783, p. 305.) The appellation Thibet, which in the east is pronounced Tibbit or Tibt, may probably signify, as has been conjectured, the kingdom of Boot or Budha, or the divine kingdom, in reference to its being the chief seat of a religion which prevails over the whole of central Asia. But on conjectures such as these, no great confidence can be placed.

An uncertainty, similar to that which attaches to its name and boundaries, prevails as to its divisions: an uncertainty which the mixture of Thibetian, Chinese, and Mongolian names render the more inveterate. It is said to contain eight provinces; but the most common division is Upper, Middle, and Lower Thibet; or Little Thibet, and Thibet Proper or Great Thibet.

Thibet forms the highest table-land in Asia, and is the nucleus from which the largest rivers of that continent take their rise, and flow towards every point of the compass. The country exhibits few high mountains in its interior, but its frontiers, particularly on the south and west, can boast of mountain chains, the peaks of some of which are the most elevated known in the world. Thibet is remarkable rather for its general elevation as an extensive plateau, varied, however, by considerable abrupt inequalities, than for any other circumstance. The valleys, of great extent, formed by the bleak and barren eminences in question, generally extend east and west. From the appearance of its surface, the country would seem nearly incapable of culture. Naked rocky hills, and plains as arid and gloomy as they are extensive, both without almost any visible vegetation, form the physical appearance of Thibet.

The mountains referred to as stretching along the southern and western frontiers of Thibet, are thought to correspond with the *Imaus* or *Hemodus* of the ancients; and the Himalaya range, so ably described by Mr. Baillie Fraser, form a part of them. For a minute account of this celebrated chain, we refer to our article HINDOSTAN; but we may mention here that Dwawalagiri or the white mountain, the highest peak of the Himmaleh range, is estimated at 26,862 feet above the level of the sea. Thibet abounds with many similar ranges, but of incomparably inferior elevation. The most celebrated rivers in Asia take their rise in the elevated and mountainous country which we are describing, namely, the Indus, Ganges, Burhampooter, "the river of Brahma," belonging to Hindostan; the Irrawady, the May-kian and Meinam, flowing through the Eastern Peninsula; and the Hoang-ho and the Yang-tsi-kiang, the two largest rivers in China. Whether the streams that flow through Siberia and Western Tartary have their origin in the country under review, or in the contiguous plateau, named the Desert of Cobi, or where the boundary lies between the two territories, our geographical knowledge is too limited to enable us to ascertain. The lakes of this country, though little known, are represented by geographers as numerous. The largest is the Terkiri, about 70 miles long and 25 broad. We shall afterwards speak of a considerable one, which produces tincal or crude borax. The lake of Yambro is represented as a large ditch or canal, 5½ miles broad, surrounding an island about 100 miles in diameter. Within a range of 300 miles, toward the north and west of Terkiri, there are twenty-three lakes which have no outlet, or which flow one into the other. We remark, among others, to the north-east of Thibet, the Hoho-nor, or Koho-nor, of great extent, in a very elevated situation, which has no outlet. These lakes are frozen in winter to a great depth. (*Malte Brun*, II. 14.)

The climate cannot be supposed to be very genial. It is indeed the reverse, to an extent altogether unknown in any other country of a corresponding latitude. "At 28° 18′ of north latitude, not far from the torrid zone, the wind," says Captain Turner, "was violently high in the month of September, and so sharp, that we dared not expose our faces to its fury: the want of caution on the preceding day had left on our faces sad memorials of its keen rudeness; and we now rode muffled up in such a manner that we could but just breathe." Such also is the intensity of frost in this quarter, that animals exposed in the open fields are not unfrequently found dead, with their head absolutely split by its force. On the summits of the hills, springs are often seen arrested in their fall by frost, and converted into solid monuments of ice, firmly fixed till the heat of summer dissolve them. Some of them are of prodigious bulk and altitude, resembling immense columns, contributing, with the universal nakedness of both hills and valleys, to impress on the mind of the traveller an indelible conviction of the bleakness of the region, and the severity of the climate. The inhabitants, at such a crisis, are not unfrequently forced to seek refuge in sheltered valleys and hollows, or in the cliffs of the rocks. It may also be stated, as a proof of the severity of the cold, that the Thibetians kill their meat, chiefly mutton, in the beginning of winter, and expose it to the action of the air; owing to which process (by which all the juices are completely dried up, and the whole becomes one uniformly stiffened substance) it is preserved quite fresh till the end of the season. This extreme cold, however, is confined to the three middle months of winter, which lasts double that time, namely from October till March. The rainy season commences in June, and continues without interruption for three months; which period constitutes summer.

Under such circumstances, Thibet cannot be supposed to be a very salubrious country. Disease, indeed, is very prevalent. Coughs, colds, and rheumatism, as might be expected, are common. Liver and bowel complaints, and fevers, are less general. Small-pox is a disease so dreaded, that when it appears in a village, the healthy have been known to desert it, and leave the affected unattended. Glandular swellings in the throat, like the goitres of Switzerland, are also prevalent in some districts. (For an account of the nature and cure of this disease, see SWITZERLAND.)

From the inclement nature of the climate, agriculture has not arrived at great perfection in Thibet. In truth, physical disadvantages, in this respect, seem to be insuperable. So violent are the winds in winter, that, on the approach of that season, the inhabitants cover their lowlands with water, with a view to have them encrusted with ice, to prevent their being stripped of their soil by the storm. Tillage, therefore, cannot be begun till the ice disappears. Their mode of thrashing farther shows the rude state in which agriculture is placed. "When the corn," says Turner, "is sufficiently hardened, a number of cattle are brought, a circle is cleared, and they are driven in a ring round a centre, to tread the grain from the ear, as fast as it is thrown under their feet." (p. 354.) Their species of grain seems to be confined to wheat, pease, and barley. The cold, however, is sometimes so intense that the crops cannot arrive at maturity; and they are made use of as fodder for the cattle during the depth of winter.

Nor, under such circumstances, can their pasture be expected to be good. It is really bad in the extreme. The rainy season gives rise to a scanty herbage, which, on the approach of dry or winter weather, immediately withers, and, on being rubbed between the fingers, crumbles into dust: yet large droves of cattle feed upon it; for it is a singular fact, that animals, ranging in a state of nature, prefer such food to the exuberant herbage of milder climates.

Notwithstanding the inclemency of the climate and the general sterility of the soil, Thibet teems with animal life, and can boast of some species peculiar to itself. Of these latter, one of the most striking and least known to Europeans is the musk-deer or *la*, in the language of the country. "This animal," to use the words of Captain Turner, "is about the height of a moderately sized hog, which in the figure of its body it much resembles. It has a small head, a thick and round hind-quarter, no scut, and extremely delicate limbs. The greatest singularity in this animal is the sort of hair with which it is covered, which is prodigiously copious, between two and three inches long, and grows erect all over the body, lying smooth only where it is short, viz. on the head, ears, and legs. Such roughness is found to consist more of the nature of feathers than of hair; or rather it resembles the porcupine's quill; yet it is thin, flexible, not straight, but undulated. The musk is a secretion formed in a little bag or tumour, resembling a wen, situated at the navel, and is found only in the male. The musk-deer is the property of the state, and is hunted only by the permission of government. It cannot be domesticated. It delights in intense cold, and is always found in places bordering on snow. It has never been seen in any other country but Thibet and Tartary; and when taken from its own climate, it gradually dwindles and dies." (Ib. p. 200–1.) The Thibetian breed of sheep is very valuable. Flocks of them are numerous; they are of a small size, with black heads and legs; their wool is soft, and their flesh almost the only kind used in Thibet, and which being preserved, as before stated, by being exposed to the action of cold, is pronounced by Captain Turner to form the finest mutton in the world. They are used as beasts of burden; they carry from twelve to twenty pounds; and whole flocks of them are occasionally employed in this capacity. Their skins, which are commonly cured with the wool on, form the winter dress of the natives and of travellers. The fleece of the lambs is of exquisite softness, and brings a great price, particularly in Tartary and China, being used in these countries for lining clothes and as fur. The bull of Thibet, called also the *yak* of Tartary, is the last species of animal peculiar to this climate, which here requires a minute description. It is about the size of one of the English breed, but so hairy that its fleeces flow down so far as the knee, and sometimes trails on the ground; so that not a joint or a muscle is seen. These bulls are of all colours, but black and white predominate. They do not low like the cattle of England, but make a grunting noise scarcely audible. They pasture in the coldest parts of the country. They are never employed in agriculture, but are used as beasts of burden. Their tails, known by the name of chowries, are used in India to drive away insects, or as an ornament upon horses and elephants. The horses of Thibet, which are extremely docile, are small like our ponies. There are some beasts of prey, as the tiger and the ounce. The lakes abound with wild geese, ducks, teal, storks, and cranes. We have, as yet, obtained no knowledge respecting the fish and insects of this singular country. Of the goats of Thibet, an account may be found under the article SHAWL-GOAT, in Vol. xvii. p. 101.

Nor is the mineral kingdom of Thibet much less important than the animal, which we have just described. Gold is very common, both in the form of gold-dust and in masses and veins. The adhering stone is generally flint or quartz; and Dr. Saunders sometimes saw a half-formed impure sort of precious stone in the mass. There are mines of lead, copper, and iron. The Thibetians work cinnabar mines, which abound in quicksilver; and they know how to employ that metal as a specific, as in Europe. Rock-salt is also common. There are no coal mines; but as this useful species of fuel is abundant in some parts of China bordering on Thibet, it may, ere long, it is probable, be found to exist also in that latter country. But the most singular product of this country is tincal or crude borax. "Tincal, the nature and production of which we have only hitherto," says Dr. Saunders, "been able to guess at, is now well known; and Thibet, from which we are supplied, contains it in inexhaustible abundance. It is a fossil, and is found deposited or formed in the bed of a lake; and those who go to collect it, dig it up in large masses, which they afterwards break into small pieces, for the convenience of carriage, exposing it to the air to dry. Tincal is used in Thibet for soldering, and to promote the fusion of gold and silver. (*Turner*, p. 406; or *Phil. Transactions*, v. lxxix.)

The Thibetians can hardly be said to engage in any kind of manufactures. Most of their exportable products they sell in a raw state. Shawls, to a limited degree, and a coarse species of woollen stuff for their own use, form their chief, if not their only manufacture. Nor, unless coal is found in abundance, will they ever be a manufacturing people, on account of their want of fuel. The dung of animals forms at present their principal fuel. But though manufacturing industry is at so low an ebb with them, the products of the country are so peculiar and valuable, that their commerce is very considerable. Their chief exports are the hair of the shawl-goat, which they send in a raw state generally to Cashmere; musk, tincal, gold-dust, rock-salt, skins, coarse woollens, the manufacture of Thibet, to the inhabitants of Tartary, China, and Bootan. The imports consist of silk, cottons, English broad cloths, bullion, trinkets, such as snuff-boxes, knives, scissors, optical glasses, and the spices and aromatics of Bengal. But the Chinese, to whom Thibet is virtually a vassal, have of late forbidden all intercourse between that country and Bengal: they have also excluded foreign merchants from Thibet.

The population of Thibet has not been ascertained, as no census has ever been taken, and the knowledge acquired by strangers has not been sufficient for supplying the defect. The Chinese estimate it at 33,000,000, a number far exceeding the truth. Half a million has been conjectured as nearer the reality. But certainly, from the barren nature of the country, and the thinness of its inhabitants, the number cannot exceed three millions, of which the men form more than a half. The men are generally stout, with a little of the Tartaric features; the women of a ruddy brown complexion.

The Thibetians have been described as "gentle, humane, and hospitable. Without being servilely officious, they are always obliging; the higher ranks are unassuming, the inferior respectful in their behaviour." (Ib. p. 350.) They are so charitable that the country is overrun with beggars, some of them from other countries, attracted thither by the character of the people. The Thibetians, however, are indolent, not ingenious nor ambitious, rude and contented with little. Their houses are formed of stone, but are mean and uncomfortable. The luxury of bedsteads they know not; their bed consists of a mattress spread on the floor, and being rolled up during the day serves as a seat. The castes of Hindostan are unknown in Thibet. Presenting a silk scarf forms an essential part of the ceremonial of salutation. If persons of equal rank meet, an exchange takes place; if a superior is approached, he holds out his hand to receive the scarf, and a similar one is thrown across the shoulders of the inferior, by the hand of an attendant, at the moment of his dismission. This practice, of which the origin and meaning have been lost, obtains in various countries of central Asia.

Some singular customs prevail among them. The ceremony of marriage, for example, is peculiar. Their courtships, says Captain Turner, are carried on with little art, and are quickly brought to a conclusion. The elder brother of a family, to whom the choice belongs, when enamoured of a damsel, makes his proposal to the parents. If his suit is approved and the offer accepted, the parents, with their daughter, repair to the suitor's house, where the male and female acquaintances of both parties meet, and spend three days in music, dancing, and every kind of festivity. At the expiry of this time, the marriage is completed. In these ceremonies, the priest has no share. Mutual consent is the only bond of union; but dissolution of marriage may take place by the agreement of the parties; but in such a case a second alliance on either side is forbidden. But these are not the most peculiar circumstances respecting marriage. Polygamy is allowed, in a sense different from that which obtains in any other country. The wife is allowed a plurality of husbands. The elder brother of a family possesses the privilege of choosing a wife, but after marriage she becomes the common property of all the brothers, whatever be their number.

Their burials are not less singular than their marriages. Inhumation is unknown among them; and the practice of the Thibetians, in this respect, is in direct opposition to that of other nations. In Thibet no attention is paid, or reverence is shown, to the remains of the dead. The body is exposed in the open air, and allowed to be devoured by dogs and carnivorous birds. Sometimes it is cast into the nearest river. The body of the sovereign Lama, however, is treated with high respect. It is preserved in a shrine, looked upon as sacred, and visited with religious awe. That of an inferior Lama is burnt, and the ashes preserved with great care in little hollow images of metal.

But probably the religion of the people under review is their most interesting feature. Thibet is the chief seat of that faith which prevails throughout the wide extent of Tartary, and among all the nations east of the Burhampooter. It is an offspring of Budhism, and is supposed to have been derived from Hindostan, to the religion of which country it still bears, in its outward form, a striking resemblance. The spiritual head of the faith in question is styled the Lama, or Grand Lama, a term signifying *priest*, and is analogous to the word pope, among the Roman Catholics. According to the theogony of Thibet, there is no demise of the Grand Lama; a metempsychosis takes place, and the same divine soul, it is believed, eternally subsists in the supreme pontiff, though under different human forms, which he deigns successively to assume. The Lama of Thibet is acknowledged, and is reverenced as the head of the church, by all those nations in central and eastern Asia to which we have already referred. There is in Thibet a consecrated priesthood, who must lead a life of celibacy, set apart for the sacred office. Monasteries and nunneries are abundant, and are similar to those in Popish countries.*

The Grand Lama, while he is the spiritual head, is also the civil ruler of Thibet. But his civil power is merely nominal, and Thibet enjoys only the shadow of independence. The Lama, in order to devote himself more fully to spiritual things, was always in the habit of appointing a tipa or secular regent; but this office, as shall be immediately more fully shown, is now in the hands of the Chinese, who may be said virtually to govern the country in question. Of the laws of Thibet, we have little information, but they are supposed to resemble those of Hindostan. It has been supposed that the Thibetians cannot raise an army of more than 50,000 men. Owing to their poverty, their revenue cannot be very ample.

The language of Thibet bears a striking resemblance to the Chinese, but, like the European tongues, it reads from left to right. Printing, which was early introduced, is performed not by movable types, but by means of set forms, composed of wood, as in China (*Vide* PRINTING.) Fibrous roots of a small shrub serve the purposes of paper; and the leaves of a book, when finished, are loosely put together and placed between two equal slips of wood as covers. The character which is employed for printed works is called *uchen*, and bears some analogy to the Sanscrit: that used for correspondence and the more ordinary business is termed *umin*. The Thibetian writings are said to be no where equalled for obscurity: but of the real nature of their literature, if such a term is applicable to them, scarcely any thing is known. Captain Turner found the Thibetians acquainted with the satellites of Jupiter and the ring of Saturn, and the existence of the planets. They were acquainted also with the game of chess; and the rules and movements which they adopted are those which obtain in Europe. Their year is lunar, and the month consists of 29 days. Their knowledge of history and geography is extremely limited.

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* It has been supposed that the Nestorians, who introduced Christianity among the Chinese and the Tartars, (*Mosheim*, ii. 60, *et seq.*) promulgated it also in Thibet; and that in consequence the religion of this country bears some resemblance to the Roman Catholic. But for this opinion, though it may be founded in truth, and indeed is not improbable, there are no sufficient data. (*Malte Brun*, ii. 636.)

According to the official Chinese geography, Thibet contains sixteen towns; but most of them, properly speaking, are only villages in the neighbourhood of some monastery or temple. Lassa is the capital, situated on a plane near the centre of the kingdom. It is the seat of government, and is crowded with noble and royal personages, who come from various parts of Asia to pay homage, and offer gifts to their earthly divinity. Within seven miles of it is Patala, "the holy mountain," on which is the temple of the Grand Lama. Ascardo or Eskeidon is the capital of Little Thibet. Other towns are unknown.

Of the history of this country scarcely any thing is known. It is mentioned by the ancients, under the vague name of *Scythia extra Imaum*. Marco Polo did not enter the country, but he gives a curious, and not very inaccurate description of it under the name of *Tebeth*. Lamaism was established about the beginning of the eighth century; but the remote situation of the country, and the quiet nature of the succession of the Lamas, afford no materials for history; at least none interesting to Europeans. The Chinese, by interfering in some intestine commotions, obtained the ascendancy in 1720. But this ascendancy became more ample towards the end of last century. In 1792, Thibet was overrun by the Nepaulese; but the Chinese interposed, defeated the invaders in several actions, and extorted from them an ignominious peace. This established on a firm foundation the Chinese influence in Thibet. The country submitted to the rule of a governor sent from China; and a constant communication is maintained between the two nations. The Chinese, however, most cordially recognize the spiritual sovereignty of the Lama, and even nominally his civil authority, though in truth this latter is solely in their own hands. The Chinese, as by their timid and jealous policy they excluded foreign merchants from the country, have, as previously mentioned, forbidden all intercourse between it and Bengal, to the great disadvantage of both countries. Bootan is tributary to Thibet; and Little Thibet, which at one time seems to have been an independent territory, now forms an integral part of the country, of which we now conclude the account.

For some incidental notices respecting Thibet, see *Voyages per Pallas; Descriptions Geograph. de la Chine et de la Tartarie Chinoise, par Du Halde*, and other works; but the best and only full account is contained in Turner's *Account of an Embassy to the Court of the Teshoo Lama*, in 1783, published in 1800. See also Murray's *Hist. Acc. of Discoveries and Travels in Asia.* (T. M.)

THIRSK, a borough and market town of England in Yorkshire, on the rivulet Coatbech, which runs through the town, and is crossed by two stone bridges. It consists of two parallel streets, united with a third, and contains some handsome and modern houses. The church, which stands on an eminence, is a handsome Gothic building, admired both for its external and internal ornaments. There are also churches for the calvinists, quakers, and methodists. Old Thirsk sends two members to parliament, who are elected by fifty burghers. The manufactures are coarse linens, white and black hardens, sackings, &c. The moat and rampart of its ancient castle still remain. Old Thirsk consists of a long range of cottages, and two squares of cottages. In one of these squares, called Haum (Elm) Green, stands a venerable elm, under whose shade the members of parliament are elected. It was on this spot that the earl of Northumberland is said to have been beheaded by the mob in the reign of Henry VII. Population of the borough and township, in 1521, 564 houses, 577 families, and 2533 inhabitants. See *Beauties of England and Wales*, vol. xvi. p. 281.

THOMAS, ST. an island on the coast of Africa, and in the gulf of Guinea. It is about 30 miles from N. to S. and about 15 miles broad, and situated under the line, the equator passing five or six miles to the N.N.W. of its northern extremity. There is a lofty mountain in its centre, from which the rivulets flow in all directions, and which, according to captain Sabine, is about 7000 feet high. The island is composed of a compact and heavy basaltic rock, covered by a rich soil, principally of vegetable composition, and is thickly wooded in every part. Rice and millet are the principal grains that are cultivated, and yams and other roots are used in place of bread. Sugar is exported in great quantities. The town of Povoacom, on the east side of the island, contains 700 houses, and is defended by several forts. It has good water, and abounds in excellent live stock, particularly in hogs, which are fattened on sugar canes. The ascent of the central mountain is practicable. East Long. 6° 25′. Captain Sabine found the latitude of the mansion house of Fernandille, in Man of War-bay, to be 0° 24′ 41″.2 north. See Captain Sabine's *Pendulum Experiments*, p. 33, &c.

THOMAS, ST. a Danish West India island, and the chief of the Virgin islands. It is about 18 miles in circumference. It has a safe and commodious harbour, in the centre of which there is a small fort. The town, which is about 50 or 60 yards to the west of the harbour, consists of a long street, at the end of which is the Danish factory, with commodious warehouses. The houses, which are one story, are mostly of brick. On the right side of the factory is the Brandenburg quarter, containing two small streets. This island carries on a considerable trade. When in the possession of Great Britain, its exports amounted to £800,000, and its imports to above £300,000. Sugar and tobacco are the chief articles of export. Millet, potatoes, and manioc are extensively cultivated. West Long. 64° 50′. North Lat. 18° 22′.

THOMAS, county of Georgia, bounded W. by Decatur, N.W. by Baker, N. by Irwin, E. by Lowndes, S. by Jefferson county, Florida, and S.W. by Leon county, Florida. Length, from south to north, 50 miles; mean breadth 30 miles, and area 1500 square miles. N. Lat. 31°, and Long. 7° W. from Washington City, intersect very near the centre of this county. Declivity southwardly; the western part drained by Ocklockonne river, and the eastern by Suwanne river, both of these streams rising in Irwin county. Chief town Thomasville.

This is a new and thinly populated county, containing, in 1831, only two post offices, one at Thomasville, and the other at Duncansville. For population, 1830, see article UNITED STATES, sect. GEORGIA. DARBY.

THOMSON, JAMES, author of "the Seasons," &c. was born on the 22d of September, (N. S.) 1700, at Ednam, Roxburghshire, a village about two miles from Kelso, delightfully situated on the Eden, from which it derives its name. His father, the Rev. Thomas Thomson, was minister of the parish of Ednam, in the Scottish Established Church, and is said by Murdoch, in his life of our poet, to have been highly respected for his piety and his diligence in the pastoral duty. He is several times mentioned, however, in that curious and scarce book, "Kirkwood's Plea with the Kirk," in his official character, as a member of the church courts, in a strain of irony and sarcasm, in which many of his brethren share. That ingenious and clever, but rash and somewhat coarse writer, had smarted under the long process to which he had been subjected; and having gained his plea, through the favour of the Scottish Privy Council, he does not spare his former prosecutors and judges. The maiden name of the mother of the poet was Beatrix Trotter, daughter of Mr. Alexander Trotter of Widehope, in the parish of Morebattle, Roxburghshire, though Murdoch, the intimate friend and earliest biographer of the poet, and several others who have copied the error, call her Hume. She was one of the co-heiresses of the small estate of Widehope, which now belongs to the Marquis of Tweeddale. The father of Thomson removed from the pastoral charge of Ednam, when James was little more than two years of age, to that of the parish of Southdean, a few miles south from Jedburgh, where he continued to perform his ministerial duties till the time of his decease. Of this change of his residence, his biographers, probably ignorant of the fact, take no notice; though the affectionate bard, who was alive alike to the perception of rural beauty and the charms of moral sentiment, refers, in his "Seasons," to Tweed, which runs along the southern part of the parish of Ednam, as his "*pure parent stream*," and also to the "*sylvan Jed*," near which the years of his boyhood and early youth were passed.

He received the usual school education at the county town of Jedburgh. The school was then taught in an eastern aisle of the fine old Abbey, and some traditionary anecdotes connected with this part of his history still remain. From school, he was sent to the College of Edinburgh, where, in the second session of his course, his studies were painfully interrupted by the illness of his father, whom he tenderly loved, but whom he was not so fortunate as to see alive, though he is said to have hastened to his manse in the country with all the speed that filial duty could dictate. His sorrow on occasion of his father's death was deep and lasting.

His now widowed mother, whose talents, piety, and worth made her beloved and respected by her family and friends, appears, from certain letters written to her by her son, to have been a severe sufferer under this domestic calamity; but though cast down, she was not in despair. By the advice of her friends, she mortgaged her share of the small inheritance which belonged to her, and removed with her family to Edinburgh, where she resided during her son James's college studies; and, after his removal to London, to the time of her decease. Thomson had been early designed to follow the profession of his father, as a clergyman of the Church of Scotland. But there is strong reason to think that divinity was not at any time his favourite study. Like Ovid and Pope, "he spoke in numbers for the numbers came." He cared so little, however, about the early productions of his muse, that he consigned them to the flames each new-year's day, and wrote occasional verses on their destruction.

He was, nevertheless, enrolled among the students of divinity, under Dr. Hamilton, senior, the professor of that science in Edinburgh. In the first of the prescribed exercises which he delivered in the Divinity Hall, as the class-room is called, and which exercise is believed to have been a lecture on the 8th Psalm, he indulged so much in a strain of poetic illustration and gorgeous phraseology, that the learned professor thought it his duty, in criticizing the production of his pupil, to censure him for his exuberance of ornament, and to counsel him to prefer in future the path of sober reasoning and scriptural illustration to the more flowery, but less becoming mazes of fancy. This *critique* seems to have been the immediate cause of his renouncing studies which had no charms for him, and to have determined him forthwith to seek distinction in his more favourite pursuits, and in a different and wider sphere. Yet, among the predisposing causes which led him to the adoption of this important change in the fortune of his life, it is curious to remark, that he had been previously distinguished by the notice and kindness of Sir William Bennet of Grubet, at whose romantic residence of Marlefield, near the banks of the Kail and Teviot, he passed many pleasant days. This gentleman, distinguished as the friend and patron of Allan Ramsay, is remembered as a man of elegant literature, a scholar, and a wit. It is still more worthy of remark, that he enjoyed the unwearied attention and kindness of the Rev. Robert Riccaltoun of Hobkirk, incorrectly called *Riccarton*, by Murdoch and others, a co-presbyter and friend of his father. Mr. Riccaltoun was a man not only of great theological knowledge, of which his writings, and especially his posthumous works, afford ample proof; but what is more to the present purpose, and is very little known, was also endued with poetic taste and genius. We shall have occasion speedily to refer to this more particularly. In the meantime, we notice it for the purpose of observing that the society of this truly eminent person tended to foster his juvenile predilection for the muses. Previous to his bidding farewell to Scotland, his academical progress seems to have been very slow, having probably suffered seasons of interruption by his residence in the country as a family tutor. Of this period of his life, few traces can now be found; but it is known that he passed a considerable time in the noble family of Cranston, then resident at Crailing near Jedburgh, and afterwards in that of Lord Binning, who was married to the heiress of Mellerstain. This lady, who was the grand-daughter, on the male side, of the celebrated patriot Robert Baillie; and on the female side, of Patrick Hume of Polwarth, afterwards Earl of Marchmont, was an early patron and friend of our poet. Thomson had also been distinguished by the friendship of the Elliots of Minto, in Roxburghshire.

He appears to have gone to London early in 1725, in the character of tutor to Lord Binning's family. A letter, in Thomson's own hand-writing, is now before us, dated from East Barnet, where Lord Binning's family then resided, in July of that year. He soon after, in the same season, settled in London, trusting, for a livelihood to his poetical talents, till his friends should find him some permanent situation. Of these friends, one of the most valuable was Mr. Duncan Forbes, then attending his duty in parliament, and whose character as a scholar and a judge, a patriot and a christian, have secured for his memory a lasting and well merited reputation. Though naturally of an easy and indolent temper, Thomson felt the necessity of exertion, and was so happy as in his first public enterprise to appropriate a theme worthy of all his genius. Its origin appears from a most interesting letter to his beloved companion, Dr. Cranston, then residing at Ancrum with his father, the amiable and respected minister of that parish, which appears, though without a date, to have been written early in the winter of the year 1725, not long after he had settled in London. He begins by complaining of his poverty, and asking a small temporary loan from his early friend: he then rises gradually into the sublimity of poetic emotion, and gives a sketch of a part of his Winter, and several appropriate quotations from the unfinished production of his muse. But what gives the chief interest to this letter is, that he distinctly states the source whence he drew the idea of his great yet simple plan of *The Seasons*. We shall give the passage, in connexion with the chain of associations by which it is naturally introduced.

Having finely pourtrayed his friend as contemplating the fading glories of the year, on the romantic banks of the stream where they had spent together many pleasing hours, Thomson thus proceeds, "There I walk in spirit, and disport in its beloved gloom. This country I am in is not very entertaining; no variety but that of woods, and them we have in abundance. But where is the living stream, the airy mountain, and the hanging rock, with twenty other things that elegantly please the lover of nature? Nature delights me in every form. I am just now painting her in her most lugubrious dress, for my own amusement, describing winter as it presents itself," &c.—"*Mr. Rickleton's poem on winter, which I still have, first put the design into my head.* In it are some masterly strokes that awakened me. Being only a present amusement, 'tis ten to one but I drop it whenever another fancy comes cross." The letter of which this extract forms a part, was first published in the first number of the Kelso Mail, from the original, with an introduction from the hand of the present writer, stating the circumstances in which it was brought to light, so as clearly to establish its genuineness and authenticity. Much unavailing labour has been since used to discover the poem of Mr. Riccaltoun here alluded to. The venerable Dr. Somerville of Jedburgh, now the father of the Church of Scotland, and still in advanced age enjoying much of the mental vigour of youth, says, he remembers to have heard part of it recited by the author, and thinks he learned from himself that it was printed in a miscellany about 1718 or 1720, under the title of "*Prospect of a Storm from Ruberslaw.*" It may yet, however, be discovered. In the mean time it appears certain, *first*, that Thomson's *Winter*, the first of "*The Seasons*," was begun, not, as some have alleged, before the poet removed from his native land, otherwise Dr. Cranston, his confidential friend, must have known it; *secondly*, that it was composed soon after his arrival in London, more with the view of pleasure than of gain; *thirdly*, that the idea originated in his admiration of the congenial poem of his respected counsellor and friend Mr. Riccaltoun; and *lastly*, that he seems hardly at this time to have contemplated the conclusion of this part of his plan, far less the extension of the subject to the other "Seasons."

Winter was published by Millar, London, in March 1726, and though at first it excited little notice, yet it speedily attained such popularity as to raise its author into the first rank of our national poets. It secured for him friends and admirers of every rank, and laid the foundation of an honourable and enduring fame. In the course of the same year, a second edition of it appeared. Summer next appeared, in 1727; Spring in the course of the same year, and Autumn not until 1730, when it formed part of the first quarto edition of his works.

In 1727, besides his *Summer*, as already mentioned, he published his poem on the then recent death of Sir Isaac Newton, which Dr. Johnson, in his "Life of Thomson," says, the poet was enabled to perform as an exact philosopher, by the aid of Mr. Gray. This may be a correct statement, though it is given without authority. If true, it is by no means discreditable to the author; for a man of profound knowledge on one class of subjects may, from that very circumstance, be ignorant of others. Nay, the intense application of the mind to works of imagination, has a tendency to loosen its hold on the scientific attainments it had formerly made. But that Thomson, though chiefly occupied with intellectual and moral themes, was not ignorant of the principles of Natural Philosophy, as seems to be insinuated, appears from many distinct passages of the *Seasons*, and from the general structure of the work. In the same year he published Britannia, in which there are fine passages. Yet, as it may be regarded as an opposition political pamphlet in verse, written for a particular purpose, though under excited feelings, it occasioned but a temporary and a partial interest, and is floated down to posterity, only by the buoyancy of his more finished and popular productions. A short time after, he wrote and produced on the stage, under very auspicious circumstances, and high anticipations of success, the tragedy of *Sophonisba*, the actual popularity of which, however, was brief, and seems never to have been great.

Fortune now spread her canvas before him, but he did not long enjoy her prosperous gale. Recommended formerly to the notice of the Lord Chancellor Talbot, by Dr. Rundle, Bishop of Derry, Thomson was now engaged by that eminent lawyer and statesman to travel on the continent with his son, Mr. Charles Talbot. The ardent love of liberty which Thomson seems to have cherished as an instinct of his nature, and which glows in various parts of his writings, connected with his *amor patriae*, led him to contrast the advantages of his own country with the degraded condition of other nations. His much loved companion was cut off by an early death, not long after their return to England. He now employed much of his time in composing his long and elaborate poem entitled *Liberty*, in the exordium of which, he bewails in strains of unaffected tenderness, the loss of that friend, whose encouraging praise and congenial feelings, he expected would have cheered and animated his exertions. This poem, which occupied his leisure for several years, was published in 1736.

In the mean time, and soon after his return to England, he had been appointed by the Lord Chancellor Talbot, his secretary of briefs, an office which, while it afforded him a respectable income, left him sufficient leisure to prosecute his favorite studies. This office he did not long enjoy, as it was lost to him in consequence of the death of the Chancellor in 1737. He was now again thrown for support on his poetical exchequer; and in 1738 his tragedy of *Agamemnon* was performed at Drury-lane with considerable success. He was introduced by Lyttleton to Frederick, Prince of Wales, who soon after settled upon him a pension of 100*l.* a year. In 1739 another of his tragedies, *Edward and Eleonora*, was offered to the stage, but, in consequence, as it is believed, of his connexion with the Prince of Wales, then the avowed head of an active opposition, and of certain political allusions in the piece, was refused a license by the Lord Chamberlain. In 1740, Thomson, with some assistance from Mallet, wrote, for the amusement of the Prince's Court, *The Masque of Alfred*, which was performed at Cliefden on the birth-day of the Princess Augusta. For several succeeding years we have little information of his employments. In 1745, his tragedy of *Tancred and Sigismunda* was produced, and acted with great applause. Its reputation continues deservedly high, and it still maintains its place among the favorite representations of the stage.

The last of his works, which he lived to publish, was the *Castle of Indolence.* This is the most finished of all his productions, and along with his *Seasons*, the foundation of his lasting fame. After much of the "*limae labor, et mora,*" it appeared in 1746, and is still regarded, particularly the first canto, as among the most exquisite productions of the British Muse. About this time, his steady and illustrious friend Lyttleton, now advanced to the peerage and in office, employed his influence in securing for Thomson the appointment of surveyor-general of the Leeward Islands, which, besides supporting a resident deputy, yielded him a revenue of 300*l.* a year, at that time worth twice or thrice its present value. But the elegant leisure thus afforded him he did not live long enough to enjoy. For in autumn, 1748, returning one evening by water to his house at Richmond, after having overheated himself by walking, he was seized with a cold followed by fever, and died on the 27th of August, or (7th of September, N. S.) having nearly completed his 48th year. His remains were interred in Richmond church, without any memorial; but a brass tablet, with a suitable inscription, was not very many years ago put up in the wall of that church by the late Earl of Buchan. An edition of his works was published by Millar, who with a warmth of friendship honourable alike to the poet and the publisher, devoted the whole profits to the erection of a handsome monument for him in Westminster Abbey.

To increase the fund left by him to his surviving sisters, Lord Lyttleton, one of his executors, got introduced on the stage the tragedy of *Coriolanus*, which had been left finished by the author, and for which his Lordship wrote a prologue, that was spoken with deep emotion and powerful effect by Quin, who had long been the zealous friend of the poet. From this and other sources, after paying his debts, a considerable sum was remitted to these relatives, to whom, during the course of his life, he had given substantial proof of a steady attachment.

His works have appeared in numerous forms. The most elegant edition of the *Seasons*, which we have seen, is that of London, 1814, which is illustrated with beautiful engravings by Bartolozzi and Tomkins, from original pictures by Hamilton. An ingenious French translation of the *Seasons* in verse by Poulin, was published at Paris in 1803.

In 1790 and 1791, festive meetings in honor of the poet, were held on his birth-day at Ednam, his native village; and a regular club was then formed, consisting chiefly of gentlemen of the counties of Roxburgh and Berwick, who met at that place for many years on the 22d of September, with the view of erecting by subscription a suitable monument on some conspicuous place in his native parish. The sum of about 300*l.* was raised for that purpose; and an obelisk of about 50 feet in height was at length, in 1819, erected by Mr. William Elliot of Kelso, on Ferney Hill, about a mile from the village of Ednam. This, though a plain building, and, as yet, without any inscription, is a pleasing object from various points of view, and serves to associate in the minds of the neighbouring inhabitants, and inquiring strangers, the idea of Thomson with the place of his nativity.

The limited space allotted to this article, has obliged us to be very brief in our statement of facts, and now prevents us from offering any thing more than the slightest allusion to his character as a *man* and a *poet*. He appears to have been a dutiful son, a kind and affectionate brother, and a warm and steady friend: benevolent in his affections, gentle in his manners, and moderate in his desires. His ardent love of nature, gives a high interest to his writings, and glows through his master-piece, *The Seasons*, with an intensity that must excite kindred emotions in every reader of taste and sensibility. But what constitutes the principal charm of this simple, yet magnificent work, is the exquisite skill with which he has connected in the flowing numbers of his classic muse, the most pleasing and elevated conceptions of the Author of Nature, with the contemplation of his works, through the shifting scenery of the year. The closing *Hymn* nobly concentrates in the finest strains of poetry the soundest deductions of the understanding, and the most sacred and ennobling impressions of the heart, in reference to this exalted theme. Without this, the finest description of nature falls heavily on the spirit. But the union is equally natural and graceful; and leads us to exclaim in the language of Akenside,

> Mind—mind alone—bear witness, Earth and Heaven,
> The living fountain in itself contains,
> Of beauteous and sublime!

THOMSON, Sir Benjamin, *Count of Rumford*, a celebrated chemist, was born at Rumford, (now Concord,) New Hampshire, in 1753. Having received, besides the ordinary education which the village afforded, some instruction in mathematics from the Rev. Mr. Bernard, he was enabled to discharge the duties of a village schoolmaster. In the year 1772 he married a widow of the name of Mrs. Rolfe, through the influence of whose friends he obtained the commission of major of militia, and some other advantageous appointments. He was hence led to attach himself to the royalist party, but in consequence of the success of the independent forces, he was obliged in 1773 to quit Boston, where he had taken refuge, leaving behind him his wife, whom he never again met, and his infant daughter, who about 20 years afterwards joined him in Europe.

At the evacuation of Boston in 1776 he was sent with dispatches to England, where he acquired the confidence of Lord George Germaine, by whom he was appointed secretary to the province of Georgia, an office which he never exercised.

In 1777 he began his scientific labours by a series of experiments on the cohesive strength of different substances, the communication of which to Sir Joseph Banks led to his admission as a member of the Royal Society on the 2d of April, 1779. In the preceding year he began his experiments on the strength of gunpowder, and in order to pursue them successfully, he went in 1779 on board the Victory, commanded by Sir Charles Hardy, where he spent the whole campaign. The practical knowledge which he thus acquired enabled him to furnish a chapter on marine artillery to Stalkart's Treatise on Naval Architecture. In 1780 he was appointed Under Secretary of State, and some time afterwards he succeeded, through the influence of his American friends, in raising the regiment of the King's American Dragoons. Having been appointed first colonel commandant of it, he went to serve with it in America; and at Charlestown he received the command of the remains of the British cavalry, which he often led on successfully against the enemy. In 1782 he assumed the command of his own regiment at New-York, and was sent with it to winter at Huntingdon, in Long Island. In 1783 he was appointed to conduct the defence of Jamaica: but the termination of the war led him to the more glorious occupation of advancing the true interests of his species.

His fondness, however, for a military life induced him to set out for Vienna in 1780, with the view of serving in the Austrian army against the Turks. His appearance on parade at Presburg attracted the attention of the late king of Bavaria, then prince Maximilian, who recommended him to his uncle the elector, by whom he was received at Munich with great kindness. He spent the winter at Vienna, where he met with a cordial reception; but as the war against the Turks did not take place, he returned again to Munich in 1784, after visiting Venice and the Tyrol.

Having been invited to enter the service of the Elector, he went to England to obtain leave, which he received from the king along with the honour of knighthood. On his return to Bavaria, he was appointed aid-de-camp general to the Elector, and colonel of cavalry, and he devoted the leisure which he now enjoyed to the continuation of his scientific researches, and to the preparation of those plans of reform which he wished to introduce into Bavaria. During a visit to Manheim, in 1786, he began his experiments on heat. In 1785 he was made chamberlain to the Elector, and in the same year he was admitted into the academies of Munich and Manheim. In 1785 he received the order of Stanislaus from the king of Poland; in 1787 he was admitted into the Academy of Sciences at Berlin during a visit to that capital; in 1788 he was appointed major-general of the Bavarian cavalry, privy counsellor of state, and chief of the war department.

In 1789 he established the house of industry at Manheim, and in 1790 that at Munich, which he has described in his Essays. He founded the Military Academy at Munich, improved the military police, and established schools of industry for the families of the soldiers. These great services to the state were rewarded by his promotion to be lieutenant-general of the Bavarian armies, and by a regiment of artillery. He was created in 1791 a count of the Holy Roman Empire, and obtained the order of the White Eagle.

The state of his health induced him to perform a tour in Italy, during which he had a severe illness at Naples, and on his return to Munich in 1799, he found himself unfit for active duty, and devoted himself to the preparation of the first five of his "Essays." In 1795 he came over to England with the view of publishing his Essays, and drawing the attention of the country to the amelioration of the condition of the lower orders. In 1796, he paid a visit to Lord Pelham, the Irish secretary: and such was the value of the improvements which he suggested on some of the public establishments in Dublin, that he was elected a member of the Royal Irish Academy, and received the public thanks of the Lord Lieutenant, and of the Lord Mayor of Dublin.

In 1796 he established two biennial prizes of the value of about 60 guineas, for the most important discoveries on light and heat; the one to be adjudged by the Royal Society of London, and the other by the American Academy of Sciences. An account of this prize has already been given in our article Societies, Vol. XVII.

In consequence of the advance of General Moreau to the confines of Bavaria, the Elector was obliged to fly into Saxony. At such a crisis the services of Count Rumford were required. After the battle of Friedberg, he took the command of the Bavarian army, and he succeeded in preventing both the Austrians and the French from entering Munich. When the Elector returned to Munich, Count Rumford was placed at the head of the general police of Bavaria, but the duties of his office made such an inroad upon his health, that he was appointed the Bavarian Minister at the British court, a situation, however, which was found to be incompatible with his character as a British subject. He therefore continued his residence in England as a private individual, where he projected and established the Royal Institution of Great Britain.

In the year 1800, Count Rumford paid a visit to Edinburgh, where he was consulted respecting the abolition of mendicity, and reformed the culinary establishment of Heriot's Hospital. On this occasion he was made an honorary member of the Royal Society of Edinburgh, and of the Royal College of Physicians. The American government offered him, about this time, an honorable establishment, but his engagements in Europe were incompatible with the acceptance of it.

With the view of residing permanently in England, he fitted up a house at Brompton with every contrivance for hospitality and luxury, but before it was finished the serenity of his mind seems to have been disturbed by some imaginary evils. He therefore quitted England in 1802, spending the spring in Paris and the summer in Munich. In 1803 he made a tour in Switzerland and Bavaria, accompanied by Madame Lavoisier, whom he married on their return to Paris; but this connexion was not a happy one, and the parties soon separated. The count retired to Auteuil, about four miles from Paris, and spent his latter years almost in solitude; and though he had been elected one of the eight foreign associates of the Institute, yet he did not even attend its sittings. He enjoyed a pension of £1200 a year from the Bavarian government, and spent his time in the improvement of his grounds and in various mechanical and philosophical pursuits. In the autumn of 1814 he intended to return to England; but he was seized with a low fever, which carried him off on the 21st of August, in the 62d year of his age, leaving behind him an only daughter.

The following is a list of the principal writings of Count Rumford:

1. New Experiments on Gunpowder, *Philosophical Transactions*, 1781, p. 23.
2. New Experiments upon Heat, *Id.* 1786, p. 273.
3. Experiments on Dephlogisticated Air, *Id.* 1787, p. 84.
4. Experiments on the Absorption of Moisture from the atmosphere by various substances, *Id.* p. 240.
5. Experiments on heat, *Id.* 1792, p. 48.
6. Description of his Photometer, *Id.* 1794, p. 67.
7. Experiments on the Force of Gunpowder, *Id.* 1797, p. 272.
8. On the Source of Heat from Friction, *Id.* 1798, p. 80.
9. On the Chemical Properties of Light, *Id.* 1793, p. 449.
10. On a Phenomenon on the Glaciers of Chamouny, *Id.* 1804, p. 23.
11. On the Nature of Heat, and the mode of its Communication, *Id.* 1804.
12. His Essays, in 4 vols. 8vo. Lond. 1795—1800. These Essays, which are 18 in number, were reprinted in France and Germany.

Count Rumford communicated various papers to the *Memoirs of the National Institute* of France, relating to heat and light. These papers, which are nine in number, are published in vols. vi. vii. and viii., for the years 1805 and 1807. An account of several of his discoveries and inventions will be found in this work, under the articles Gunpowder, Vol. X. p. 191; Heat, Vol. X. p. 274; Meteorology, Vol. XIII.; Optics, Vol. XIV. p. 760.

THRASYBULUS. See Athens.

THRASHING Machine. See Agriculture, Vol. I. p. 250—256.

THUNDER. See Electricity, Vol. VIII. p. 311—316.

THURSO, a seaport town of Scotland in Caithness-shire. It is situated at the head of a spacious bay on the estuary of the river Thurso. The town is irregularly built, but very elegant houses have been erected to the south of the old town. The church is an old Gothic building in tolerably good repair, and there are places of worship for the antiburghers and baptists, and congregationalists. There are two banks in the town. There is a manufacture of coarse linen cloth and of straw plait, and there is a tannery, a ropework, a bleachfield, and two distilleries in the neighbourhood. The harbour admits, at spring tides, vessels that draw 14 feet of water. Twenty decked vessels of 1241 tons register belong to the town. They are either coasting vessels or employed in the fisheries. Corn and meal are exported to the amount of £12,000 annually, and fish to the amount of £13,824. The population of the town and parish, in 1821, was 648 houses, 779 families, of whom 268 are employed in agriculture, 428 in trade, 1786 males, 2259 females, and 4045 inhabitants.

TIBERIUS. See Roman Empire, Vol. XVI. p. 414—416.

TIDES. See Astronomy, Vol. II. 623—674.

TILGHMAN, William, was born on the 12th of August 1756, upon the estate of his father, in Talbot county, on the Eastern Shore of Maryland, about a mile from the town of Easton.

His paternal great grandfather, Richard Tilghman, emigrated to that province from Kent county, in England, about the year 1662, and settled on Chester river, in Queen Anne's county.

His father, James Tilghman, a distinguished lawyer, is well known to the profession in Pennsylvania as secretary of the Proprietary Land-Office, and as having brought that department, by the accuracy of his mind and the steadiness of his purpose, into a system as much remarked for order and equity, as from its early defects it threatened to be otherwise.

His maternal grandfather was Tench Francis the elder, of Philadelphia, one of the most eminent lawyers of the province, the brother of Richard Francis, author of "Maxims of Equity," and of Dr. Philip Francis, the translator of Horace.

It is not surprising to find among the collateral ancestors of the late chief justice, the author of one of the earliest compends of scientific equity, and a scholar accomplished in the literature of the age of Augustus.

In 1762, his family removed from Maryland to Philadelphia.

In the succeeding year he was placed at the Academy, and, in the regular progress of the classes, came under the instruction of Mr. Beveridge, from whom he received his foundation in Latin and Greek.

Upon the death of Beveridge his place was filled provisionally by Mr. Wallis, who was perfectly skilled in the prosody of those languages, and who imparted to his pupils an accuracy, of which the chief justice was a striking example.

Dr. Davidson, the author of the grammar, succeeded Beveridge, and with him the subject of this discourse remained till he entered the college in the year 1769, Dr. Smith being then the provost, and Dr. Francis Allison the vice-provost, the latter of whom instructed the students in the higher Greek and Latin classics; and such was the devotion to literature of the eminent pupil of whom we are speaking, that after he had received the bachelor's degree, and was, in the ordinary sense, prepared for a profession, he continued for some time to read the classics, with the benefit of Dr. Allison's predilections.

In February 1772 he began the study of the law in Philadelphia, under the direction of the late Benjamin Chew, then at the head of his profession, afterwards chief justice of the supreme court of Pennsylvania, and at the close of the high court of errors and appeals, its venerable president.

In the office of this gentleman, he continued until December 1776, devoting himself to Littleton and Coke and Plowden, and the other fathers of the common law, at that time the manuals of the legal student, and at no time postponed in his estimation and regard to the more popular treatises of later days.

From 1776 to 1783, partly on his father's estate, and partly at Chestertown, whither his family had removed, he continued to pursue his legal studies, reading deeply and laboriously, as he has himself recorded, and applying his intervals of leisure to the education of a younger brother. When, therefore, in the spring of 1783, he was admitted to the courts of Maryland, we may infer that an apprenticeship of eleven years had filled his mind with legal principles sufficient to guide and enlighten him for the rest of his life.

In 1788, and for some successive years, he was elected a representative to the legislature of Maryland. His temper and habits were not perfectly congenial with active political life, nor was he at any time attracted by that career; but he was a republican, in the catholic sense, and took an active part in procuring the adoption of the federal constitution, to which, as well as to its founders and great first administrator, he felt and uniformly declared the most profound attachment.

In 1793, he returned to Philadelphia, and commenced the practice of the law, which he prosecuted until his appointment by President Adams, on the 3d of March 1801, chief judge of the circuit court of the United States for this circuit.*

His powers as an advocate, but more especially his learning and judgment, were held in great respect by the community, surrounded notwithstanding as he was, by men of the first eminence in the land. His law arguments, which some now present may recollect, were remarkable for the distinctness with which he presented his case, and for the perspicuity and accuracy with which his legal references were made to sustain it. He was concise, simple, occasionally nervous, and uniformly faithful to the court, as he was to the client. But the force of his intellect resided in his judgment; and even higher faculties than his as an advocate, would have been thrown comparatively into the shade by the more striking light which surrounded his path as a judge.

The court in which his judicial ability was first made known, had but a short existence. In a year after its enactment, the law which erected this court was repealed; and the judges, who had received their commissions during good behaviour, were deprived of their offices without the imputation of a fault.

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* Third Circuit—for New Jersey, Pennsylvania, and Delaware.

After the abolition of the circuit court, Mr. Tilghman resumed the practice of his profession, and continued it until the 31st July 1805, when he was appointed president of the courts of common pleas in the first district.

He remained but a few months in the common pleas. In the beginning of the year 1806, Mr. Shippen, the chief justice of the supreme court, yielded to the claims of a venerable old age by retiring from the office, and on the 25th of February, Mr. Tilghman was commissioned in his place by Governor McKean, himself a great lawyer and judge, and interested as a father in the court which he had led on to distinguished reputation in the United States.

From the time that he took his seat on the bench, at March term 1806, for the space of more than ten years, he delivered an opinion in every case but five, the arguments in four of which he was prevented from hearing by sickness, and in one by domestic affliction; and in more than two hundred and fifty cases, he either pronounced the judgment of the court, or his brethren concurred in his opinion and reasons without a comment.

His attention, from the beginning to the end of the twenty-one years that he presided in the supreme court, was undeviatingly given to every case; and he prepared himself for all that required consideration at his chamber, by taking an accurate note of the authorities cited by counsel, and of the principal heads and illustrations of their argument.

This labour was not performed to accumulate the evidences of his devotion to business, nor under subjection to an inveterate habit. He was far above all this. He did it under a sense of conscientious duty to retain such minutes as would enable him to examine the authorities, and to review the observations of counsel, after the illusion, and perhaps the excitement of the public discussion had gone by. The contents of twenty volumes of reports, and upwards of two thousand judgments, most of them elaborate, all of them sufficiently reasoned, very few upon matters of practice, or on points of fugitive interest, attest the devotion of his judicial life; and although it is not meant to deprive of their share of the merit of these labours, the eminent men who survive him on the bench, and who remain to continue, and I hope to exalt the fame of our jurisprudence, I may say, and they will cheerfully admit, that he was the presiding spirit of their consultations, as he was of their court.

In addition to these strictly official duties, the legislature of Pennsylvania committed to the judges of the supreme court, in the year 1807, the critical duty of reporting the English statutes in force within this commonwealth. The duty is called *critical*, for so undoubtedly it was considered by the chief justice. The service exacted an unlimited knowledge of our colonial legislation, and of the practice and administration of the law in the province, through a period of nearly a century, in which there was not the light of a reported case. It required also an intimate familiarity with the written law of England, its history, both political and legal, and a knowledge of the impressions which it had given to and received from the common law, during the course of many centuries. The selection, moreover, was to be made in the chambers of the judges, without the aid of that best of all devices for eliciting the truth, an ardent, free, and ingenuous discussion by counsel. I need not say to the professional hearer, that the task was Herculean. In the course, however, of less than two years, it was performed; and the profession and the public are indebted to it for an invaluable standard of reference in a province of the law before that time without path or guide. It is not perfect. It has not the obligation of judicial authority. I speak the sentiments of its principal author. Some statutes are perhaps omitted. Still the original work will remain as a monument to those by whom it was erected, and who may now be said to rest beneath it. If it shall increase at all, it will be by the contributions which the hand of respect and affection shall bring to swell the tribute to the venerable dead.

The labours thus recited, my brethren, in addition to what we know to have been performed at Nisi Prius, and in circuits through the state, entitle this eminent judge to the praise of great industry, a virtue which it is an offence against morality to call humble, in one who is the keeper both of his own talent, and not seldom of that of others also. It was, however, industry of the highest order—a constant action of the intellect practically applied.

All his opinions are remarkable for their admirable common sense, and their adaptation to the common understanding. There is no reaching after what is recondite or abstruse,—no affectation of science. The language of the law, as he uses it, is vernacular, and his arguments are the most simple that the case will bear. They are not an intricate web, in which filaments separately weak obtain strength by their union, but a chain whose firmness arises from the solidity of its links, and not from the artifice of their connexion.

But that quality which exalts his judgments the most in the estimation of the public, is the ardent love of justice which runs through them all. His appetite for it was keen and constant; and nothing could rouse his kind and courteous temper into resentment, more than a deliberate effort to entangle justice in the meshes of chicane. The law was his master; he yielded implicit obedience to its behests. Justice was the object of his affections; he defended her with the devotion of a lover. It is the high praise of his administration, and of the profession too, that the occasions were rare in which his efforts did not bring them into harmonious co-operation.

In the department of penal law he was relieved, by his office, from frequent labours, although he annually presided in a court of oyer and terminer for this county. His knowledge of this branch of the law was extensive and accurate; his judgment in it, as in every other, was admirable. His own exemption from moral infirmity, might be supposed to have made him severe in his reckonings with the guilty; but it is the quality of minds as pure as his to look with compassion upon those who have fallen from virtue. He could not but pronounce the sentence of the law upon such as were condemned to hear it; but the calmness, the dignity, the impartiality, with which he ordered their trials, the deep attention which he gave to such as involved life, and the touching manner of his last office to the convicted, demonstrated his sense of the peculiar responsibility which belonged to this part of his functions. In civil controversies, such excepted as by some feature of injustice demanded a notice of the parties, he reduced the issue pretty much to an abstract form, and solved it as if it had been an algebraic problem. But in criminal cases, there was a constant reference to the wretched persons whose fate was suspended before him; and in the very celerity with which he endeavoured to dispose of the accusation, he evinced his sympathy. It was his invariable effort, without regard to his own health, to finish a capital case at one sitting, if any portion of the night would suffice for the object; and one of his declared motives was to terminate, as soon as possible, that harrowing solicitude, worse even than the worst certainty, which a protracted trial brings to the unhappy prisoner. He never pronounced the sentence of death without severe pain; in the first instance it was the occasion of anguish. In this, as in many other points, he bore a strong resemblance to Sir Matthew Hale. His awful reverence of the great Judge of all mankind, and the humility with which he habitually walked in that presence, made him uplift the sword of justice as if it scarcely belonged to man, himself a suppliant, to let it fall on the neck of his fellow man.

Upon the whole, his character as a judge was a combination of some of the finest elements that have been united in that office. Among those which may be regarded as primary or fundamental, were a reverential love of the common law and a fervent zeal for justice, as the end and intended fruit of all law.

His early education, it has been remarked, was excellent. He was an accomplished Latin scholar, but, to his own regret, had suffered his Greek to fall away by desuetude. The literature of the former language he kept constantly fresh in his mind. His memory was stored with beautiful Latin, which he has been heard to repeat, as it were, to himself, when the occasion recalled it, and his modesty did not care to pronounce it aloud. On all his circuits and journies into the districts of the supreme court, his companions were the Bible, a Latin author, and some recent treatise of distinction in the law. Upon the last that he ever made, he refreshed his recollections of the Pharsalia. It is perhaps no idle fancy to suppose that he may have then read, with almost a personal application, the prophetic appeal of the spectre to the race of Pompey:

——— veniet quæ misceat omnes
Hora duces. Properate mori———

Such a name and such an example, are of great efficacy in the inquiry concerning the fittest basis of liberal education. All the faculties of his mind were thoroughly developed,—he accumulated large stores of knowledge,—he brought them into daily use,—he reasoned accurately,—he conversed elegantly,—his taste was refined,—the pleasures which it brought to him were pure,—his imagination was replete with the beautiful forms of ancient poetry,—he was adequate to the functions of one of the most exalted offices,—he knew little of the natural sciences,—and his education was such as has been described. It would be unjust to him, however, to say, that he undervalued knowledge of any kind, and least of all that knowledge which is opening every day to the world, and to this part of the world especially, new sources of wealth, and new proofs of the wisdom and beneficence of Deity. On the contrary, with that diffusive liberality for which he was conspicuous, he gave his counsel and his money to every plan for increasing this species of knowledge; but it cannot be asserted of him, that he recommended it, in any of its branches, as an instrument for unfolding the faculties of youth. He regarded these sciences as treasure for accumulation, after education had performed its office. For the great work of training the minds of young men to liberal pursuits, and to the learned professions, his opinion was anchored upon the system, by which he had been reared himself,—the system of the American colleges.

His moral qualities were of the highest order. It has been said, that the panegyrists of great men can rarely direct the eye with safety to their early years, for fear of lighting upon the traces of some irregular passion. But to the subject of this discourse may with justice be applied the praise of the Chancellor D'Aguesseau, that he was never known to take a single step out of the narrow path of wisdom, and that although it was sometimes remarked he had been young, it was for the purpose not of palliating a defect, but of doing greater honour to his virtues. Of his early life, few of his cotemporaries remain to speak; but those few attest what the harmony of his whole character in later years would infer, that his youth gave presage, by its sobriety and exemplary rectitude, of all that we witnessed and admired in the maturity of his character. It is great praise to say of so excellent a judge, that there was no contrariety between his judgments and his life,—that there was a perfect consent between his public and his private manners,—that he was an engaging example of all he taught,—and that no reproach which, in his multifarious employment, he was compelled to utter against all the forms of injustice, public and private, social and domestic,—against all violations of law, from crime down to those irregularities at which, from general infirmity, there is a general connivance,—in no instance, did the sting of his reproach wound his own bosom. Yet it was in his life only, and not in his pretensions, that you discerned this his fortunate superiority to others. In his private walks, he was the most unpretending of men. He bore constantly about him those characteristics of true greatness, simplicity and modesty. Shall I add, that the memory of all his acquaintance may be challenged to repeat from his most unrestrained conversation, one word or allusion that might not have fallen with propriety upon the ear of the most fastidious delicacy.

The kindness of his nature appeared in the intercourse that he maintained with his fellow citizens, notwithstanding the claims of his station. He probably entertained Mr. Burke's opinion, that *as it is public justice that holds the community together, the judges ought to be of a reserved and retired character, and wholly unconnected with the political world.* He certainly acted up to all that the sentiment asserts; and he found the benefit of it, the community did also, in a ready submission to those judgments, more than one, in which a suspected infusion of party would have been a disturbing ingredient. No one who knew him in private life, had however any reason to doubt his opinions, when the occasion fitly called for their expression. Not deeming it discreet to meet his fellow citizens in those assemblies where either politics or their kindred subjects were to be discussed, he seized with the more avidity such occasions of intercourse as were presented by meetings for public improvement, for philosophical inquiry, or the cultivation of literature; and in particular he attended with great interest to the concerns of the American Philosophical Society, of which he was chosen president, on the death of Dr. Patterson, in the year 1824, and to those also of the Athenæum, of which he was the first, and, during his life, the only president:—the trustees of the University of Pennsylvania rarely missed him from his seat, or the United Episcopal Churches, of this city, from their vestry, as the warden of his venerable friend and pastor Bishop White. It was in this way that he diminished the distance to which his office removed him from society; keeping, however, a constant eye upon that office, even when he moved out of its orbit, and taking scrupulous care, that no external contact should be of a nature to disturb his movements when he returned to it.

The temper of the chief justice was singularly placable and benevolent. It was not in his power to remember an injury. A few days before his death, he said to two of his friends, attendant upon that scene, "I am at peace with all the world. I bear no ill-will to any human being; and there is no person in existence to whom I would not do good, and render a service, if it were in my power. No man can be happy who does not forgive injuries which he may have received from his fellow creatures." How suitable was this noble conclusion to his exemplary life! What a grace did this spirit impart to his own supplications! This was not a counterfeit virtue, assumed when the power to retaliate was wasted by disease. It was not the mere overflow of a kindly nature, unschooled by that divine science which teaches benevolence as a duty. It was the virtue of one, who, in his eulogium upon his eminent friend Dr. Wistar, who had filled the chair of the Philosophical Society, thus made known the foundation on which his benevolence was built. "Vain is the splendour of genius without the virtues of the heart. No man who is not *good*, deserves the name of *wise*. In the language of Scripture, folly and wickedness are the same; not only because vicious habits do really corrupt and darken the understanding, but because it is no small degree of folly to be ignorant, that the chief good of man is to know the will of his Creator, and to do it."

It was under the influence of this sentiment that his fortune became a refuge to the unfortunate, far more extensively than his unostentatious manners imported. Notwithstanding the panoply which protected him from the assaults of this world, he was like the feeblest of his race, naked and defenceless against the dispensations of Heaven. His bosom suffered many and deep lacerations; but they had the propitious effect of opening his heart to mankind, instead of withering and drying up its affections. He was gentle, compassionate, charitable in many of the senses that make charity the first of virtues; and long after his leaves and branches were all torn away, there was more than one that reposed in the shade of his venerable trunk. His closing years finely illustrated the remark, that the heart of a good man is like a good soil, which is made more fertile by the ploughshare that tears it and lays it open,—or like those plants which give out their best odours when they are broken and crushed.

An interesting record, which this venerable man has left behind him, acquaints us with many of his most private thoughts, and presents him in a relation which no man can renounce, and which, when duly observed, is the appropriate light wherein to behold an eminent judge,—the relation of man to his Creator.

His birth-day, the 12th of August, was habitually appropriated to the review of the last year, to self-examination, and to intercourse with God; and it will not be deemed irreverent in us, the only children he has left, to cast an affectionate eye upon this record, and to draw encouragement and counsel, as well as increased veneration for his character, from the touching disclosure it makes of his fortitude, resignation, and piety.

The first of the series which has been found, begins on the 12th of August 1804, when he completed his forty-eighth year. He says—"my health is good, my constitution unimpaired, but I am deeply impressed with the uncertainty of life. Let me prepare to follow the numerous friends who have left this world before me."—"The last stage of my residence on earth is approaching. Time is precious. I must not suffer it to be wasted in indolence, or thrown away on light amusements. I have endeavoured during the course of this day, to strengthen my mind with virtuous resolutions, and I hope my endeavours have not been useless." He then repeats the resolutions he had formed for the government of his life, among which is that of "letting no day pass without prostrating himself before the Supreme Being, in meditation, thanksgiving and prayer;" and he concludes his memorial by offering, as he expresses it, "with a grateful heart, his unworthy thanks to the almighty and merciful God, for past favours, far exceeding his merits," and by "imploring with all humility, that he would graciously assist his weak endeavours to keep the resolutions he had made."

He continues this review for several years, during which his strain is that of gratitude for constant benefactions: but in the year 1817, the clouds gathered around him, the countenance of his beneficent

Creator seemed to be withdrawn, and the night of his old age was approaching, with the promise of but one feeble and ill-assured ray to relieve it from total darkness. He had been one of ten brothers and sisters, to all of whom he had borne the tenderest affection. He had been a husband, enjoying for a short time the happiness of that sacred relation. He had been the father of one child, devotedly loved for her intelligence, filial affection, and piety. Mark with what a celestial temper, if I may so speak, he records the flight of all these blessings. "I have now attained the age of sixty-one, and have survived parents, brothers, sisters, wife, and child. But few of my dearest connexions remain in this world. May this reflection induce me so to use the short remainder of my life, as may recommend me to thy favour, and procure me the happiness of once more meeting my departed friends, according to my confident hope. Lord thou hast taken away the child which thou hadst given me. I murmur not. Blessed be thy name."

Before the 12th of August 1820, that feeble ray which was promised to his declining days, was extinguished. The only child of his only daughter was taken from him. Yet observe how the light of the divine philosophy shone inward, and dispelled the gloom in which unassisted man would have sunk to despair. "Great God, during the last year, thou hast thrown me on the bed of sickness, and raised me up from it. Thou hast taken from me my last earthly hope. I submit to thy providence, and pray that thou will grant me fortitude under all my afflictions. I am sure that whatever is ordained by thee is right. May I never forget that thou art always present, the witness and judge of my actions and thoughts. My life is hastening to an end. May I, by thy gracious assistance, so employ the remainder of it, as not to be altogether unworthy of thy favour."

On the last anniversary that he ever saw, he begins his paper with the prophetic declaration, "this day completes my seventieth year, the period which is said to bound the life of man. My constitution is impaired, but I cannot sufficiently thank God that my intellects are sound, that I am afflicted with no painful disease, and that sufficient health remains to make life comfortable. I pray for the grace of the Almighty, to enable me to walk during the short remnant of life in his ways. Without his aid, I am sensible that my efforts are unavailing. May I submit with gratitude to all his dispensations, never forget that he is the witness of my actions and even of my thoughts, and endeavour to honour, love, and obey him, with all my heart, soul, and strength."

It is no longer wonderful that this venerated man performed his duties to universal acceptance, when we discern the spirit, better far than the *genius* of Socrates, from which he asked counsel. The ancients would have said of him, that he lived in the presence of all the deities, since prudence was never absent from him. The holders of a better faith must say, that it was to no poetical deity, nor to the counsels of his own mind, but to that "grace" which his supplications invoked, that he owed his protection from most of the lapses to which fallible man is subject.

That "remnant of life" to which his last memorial refers, unfortunately for us, was short, as he had predicted; but he walked it as he had done all that went before, according to his devout aspiration. He continued to preside in the Supreme Court with his accustomed dignity and effect until the succeeding winter, when his constitution finally gave way, and after a short confinement, on Monday the 30th of April 1827, he closed his eyes for ever. It will be long, very long, before we shall open ours upon a wiser judge, a sounder lawyer, a riper scholar, a purer man, or a truer gentleman. [*Extracts from an Eulogium delivered by Horace Binney, L. L. D.*

TIMBALLIER, bay of Louisiana, extending westward from the outlet of Lafourche river into the gulf of Mexico about thirty miles, with a width of from one to six miles. It has its discharge into Lafourche, and is only separated from the gulf of Mexico by a long, low, and narrow neck of land, or rather an island. It is a shallow sheet of water, with a muddy or sandy bottom. DARBY.

TIN. See CHEMISTRY, METEOROLOGY, and MINERALOGY.

TINIAN. See LADRONES, Vol. XI. p. 651.

TIOGA, river of the states of New York and Pennsylvania. See SUSQUEHANNA RIVER, Vol. XVII.

TIOGA, county of Pennsylvania, bounded E. by Bradford county of the same state; S.E. and S. by Lycoming; W. by Potter, and N. by Steuben county, New-York. Length from east to west 36, mean width 32, and area 1152 square miles. Extending in Lat. from 41° 32′ to 42°, and in Lon. from 0° 04′ E. to 0° 40′ W. from the meridian of W. C.

The surface of this county is composed of two inclined planes, the separating ridge or summit level extending from northwest to southeast. From the southwestern declination flow Pine Creek and Lycoming Creek, southwardly into the West Branch of Susquehannah river, and from the northwestern slope flow the various sources of Tioga river. The surface is broken, hilly, and partly mountainous, and may be regarded indeed as a new settlement, as in 1820 the population was only 4021, whilst in 1830 the inhabitants amounted to 9074, having gained 125 per cent in ten years.

By the post office list of 1831, besides Wellsborough, the county seat, there were post offices at Bloomsbury, Covington, Crooked Creek, Daggett's Mills, Dartmouth, Elk Land, Ingham, Knoxville, Lawrenceville, Liberty, Mainsburg, Mansfield, Nelson, Pine Creek, Rutland, Sullivan, Tioga, and Westfield.

Wellsburg, the county seat, is situated on or near the head of a small branch of Crooked Creek, Branch of Tioga, about 50 miles a little W. of N. from Williamsport, on the west branch of Susquehannah river, about 100 miles, following the road northwestward from Wilkesbarre, and by post road 147 miles a little W. of N. from Harrisburg, and 253 miles in a nearly similar direction from W. C. As laid down in Tanner's Pennsylvania, the latitude is 41° 44′ N., Lon. 0° 36′ W. from W. C.

TIPPERARY, a county of Ireland, in the province of Munster. It is about 74 miles long from N. to S., 240 from E. to W., and contains 1591 square miles, or 21,018,240 acres, which are divided into 12 baronies and 186 parishes, of which 116 are in the united sees of Cashel and Emly, 4 in that of Killaloe, and 32 in that of Waterford. It is separated from Clare and Galway by the Shannon, and from Waterford by the Suir.

The surface of this county is diversified with mountains and fertile plains. The mountains occur chiefly at the boundaries of the county, and the most important of them are the Galtie and Knockmeledon. The plains form the principal part of the county, and are remarkably productive, particularly what is called the Golden vale and the tract in which the town of Tipperary is situated. There is an extensive tract of bog in the east of the county, forming a part of the great bog of Allen, about 36,000 acres of which might be reclaimed.

The principal rivers are the Shannon and the Suir. The Shannon expands into the fine lake of Lough-derg. The Suir, after running south, takes an eastern course by Clonmel and Carrick, and, after its junction with the Barrow and the Nase, falls into the sea.

The coal district lies to the south of the bog above mentioned, between the town of Killenaule and the county of Kilkenny. The coal is the carbonaceous or stone coal, known by the name of Kilkenny coal. It is wrought on the borders of Queen's county. Lead and copper veins have been wrought near the Sliechbloom mountains, and fine millstones have also been quarried here.

The climate of Tipperary is very mild. Vegetation is seldom checked by the winter frosts, and the cattle remain out on the pasture grounds during the whole year.

The lands of the county are chiefly occupied in grazing, every variety of pasture land being found in the county. The cattle, which are long horned, are reckoned among the best in Ireland; and Mr. Wakefield is of opinion that many of the flocks of long-woolled sheep are not inferior to those of Leicestershire. Tillage farms are generally of small extent, one of 90 Irish acres being thought large. A species of flax, which grows to a great height, is raised on the rich lands, and seems well fitted for sail-cloth. The graziers in this county have often leasehold properties of much greater value than the freeholds. The estates in Tipperary are of various sizes. There are some from £10,000 to £15,000 per annum, and many from £4000 to £6000. Lord Landaff is the chief proprietor.

The principal towns in Tipperary are Clonmel and Carrick, both upon the Suir, Cashel, Fethard, Cahir, Thurles, Roscrea, Nenagh, and Tipperary. Carrick has a manufacture of ribbons. Fethard was once a walled town, but is now in a state of decay. Thurles is a long straggling town of one street, with a neat modern church and barracks. Roscrea is a neat thriving place, with an ancient church, near which is one of the largest round towers in Ireland, all built with square stone. Nenagh was formerly defended by a strong castle. Tipperary is in a ruinous condition. See our articles CASHEL, Vol. V. p. 471, and CLONMEL, Vol. VI. p. 535, for an account of these towns.

Tipperary sends four members to parliament, two for the county and two for each of the burghs of Cashel and Clonmel. There were about 12,000 freeholders in this county under the old act.

The trade of Tipperary, which consists principally in its cattle, and beef, and corn, is facilitated by the river Suir, by which it has access to Waterford and the sea on the south, and by the Barrow and Nase, and a branch of the Grand Canal, by which it communicates with Dublin on the east.

In 1792, the number of houses in the county, according to Dr. Beaufort, was 30,073, and reckoning 3½ persons to a house, the population will be 169,000, or according to Mr. Bushe, if we give 6½ to each house, the population will be 190,000. By the census of 1821, the population was found to be 353,000. The number of protestants is very small: in some places not above one in a hundred. See Wakefield's *Statistical Account of Ireland*, passim, the *Statistical Account of the Parish of Carrick* in 1815. Dr. Beaufort's *Memoir of a Map of Ireland*, and the article IRELAND, in this work.

TIPTON, county of Tennessee, bounded N. by Dyer, E. by Haywood, S.E. by Lafayette, S.W. by Shelby, and W. by the Mississippi river. Length 30, mean breadth 23, and area 690 square miles. Extending in Lat. from 35° 23′ to 35° 48′ N., and in Lon. from 12° 32′ to 13° W. from W. C. The declivity of this county is westward towards the Mississippi. Big Hatchee river, rising in the state of Mississippi, enters Tennessee, traversing Hardiman and Haywood into Tipton in a northwestern direction. In the latter, the stream deflects to westward, but with a northern curve falls into the Mississippi above the Second Chickasaw Bluff, dividing Tipton into nearly equal sections. Forked Deer river also, after traversing Madison, Haywook, and Dyer, curves into and falls into the Mississippi in the N.W. angle of Tipton, immediately above the First Chickasaw Bluff.

Except the flats along the Mississippi, the surface of Tipton county is hilly, with good soil. Staple, cotton.

By the post office list of 1831, there were post offices in Tipton at COVINGTON, the county seat, Branch, Durhamville, Fulton, Hartfield, Randolph, and Richland Grove.

Covington, the seat of justice, is situated on a small branch of Big Hatchee, about 40 miles N.N.E. from Memphis on the Mississippi, in Shelby county, and by post road, 197 miles S.W. by W. from Nashville. Lat. 35° 32′ N., and Lon. 12° 47′ W. from W. C.

TIREY,* or Tiree, an island of the Hebrides in the county of Argyle. It is about 13 miles long, and its medium breadth 2½. It contains 36½ square miles, excluding its 24 lakes, which occupy 600 acres. About one half of the island is arable. The highest grounds do not rise above 350 feet above the sea, and such is the general flatness of its surface, that the waves are often seen from the one shore apparently several feet above the level of the other. The soil varies from a black mossy earth to sand, and the crops are bear, black oats, lint, and potatoes. Kelp used to be manufactured to the extent of 245 tons annually. The minerals in the island are gneiss, which forms nearly the whole of the island, granite, whinstone, ironstone, and limestone, bright green compact fedspar, pargasite, augite, sahlite, tremolite, which are described in our article Scotland, Vol. XVII. It yields a greenish marble of great beauty, and now in general use. There is a great number of caves in the hill of Kean-mharr, which forms the west extremity of the island. The island yields no fuel —neither wood nor peat, though large roots and branches of trees are found in the mosses. The duke of Argyle is proprietor of the whole island. The valued rent of Tyree and Col is 280*l.* 10*s.* 3*d.*, and the real rent of Tyree about 1810, kelp included, was nearly 3000*l.*

In 1800 the population was 3200. There were then in the island 1500 horses, 2000 cows, 1300 hogs, and about 880 sheep.

In 1821 there was 721 houses, 733 families, 467 of which are employed in agriculture, 48 in trade, and 4181 inhabitants. See Macdonald's *General View of the Agriculture of the Hebrides*, p. 719—725, and Maculloch's *Description of the Western Islands.* See also Scotland, in this work.

TITHES. See Agriculture, p. 328—331, and Law, Vol. XI. p. 778.

TINTORETTO, Il, whose real name was Giacopo Roberti, was a celebrated painter of the Venetian school. He was born at Venice in 1512, and was the son of a dyer, from which circumstance he had his name. He died at the age of 82 at Venice, in the year 1594, leaving behind him a son and a daughter, both of whom practised the art of painting with success. An account of Tintoretto's style and pictures has already been given under our article Painting, Vol. XV. p. 310.

TITIAN, whose real name was Tiziano Vecelli da Cadore, was a celebrated painter at the head of the Venetian school. He was born of noble parents at the castle of Cadore in Friuli in 1480. He died of the plague at Venice in 1576 in the 96th year of his age. An account of his style and principal works have already been given in our article Painting, Vol. XV. p. 310—311.

TITUS VESPASIAN. See Roman *Empire*, Vol. XVI. p. 422.

TIVERTON, or Twyford-town, a borough of England in Devonshire, is situated on the declivity of a hill between the rivers Exe and Loman. The town is nearly a mile long, and three-fourths of a mile broad. The four principal streets inclose a quadrangular space forming gardens, with a bowling green in the centre. The houses are chiefly of red brick or stone, and are covered with slate, but those on the outskirts of the town are earthen and thatched cottages. The castle, the church, the town-house, and the grammar school, are the principal buildings. The grammar school is a fine building 170 feet long, erected in 1604. The castle seems to have been a quadrangle enclosing about an acre, and surrounded by walls about 22 feet high. Great part of the south and west walls, and portions of the towers at the angles still remain. The moat at the south side is converted into a good kitchen garden. The church is adorned with a good deal of interesting sculpture, and the tower, which is 116 feet high, is ornamented with battlements and pinnacles. The town-house is a strong edifice. The other public buildings are a neat chapel of ease erected in 1733, several meeting houses for dissenters, the market house, the hospital or poor's house, and two alms houses. This town has long been celebrated for its woollen manufactures, especially that of kerseys. The chief articles now made are serges, druggets, durays, sagotees, drapins, &c. Tiverton sends two members to parliament. In 1591 the plague raged in the town, which was afterwards destroyed by fire. In 1612 and 1731 it suffered greatly from fire. Population of the town in 1821, 997 houses, 1262 families, 124 ditto employed in agriculture, 979 in trade, and total population 6712. See Dunsford's *Historical Memoirs of Tiverton*, and the *Beauties of England*, vol. iv.

TIVERTON in Rhode Island. See Morse.

TIVOLI, anciently *Tibur*, a town of Italy, in the Campagna di Roma, about 18 miles N.E. of Rome. It is agreeably situated on an eminence, overlooked on one side by Monte Castali, and a circular range of the Sabine mountains. The town has a mean appearance, and contains a cathedral and several churches, the former being erected on the ruins of a temple of Hercules. The principal beauty of Tivoli arises from the falls of the Teverane, the ancient Anio, which flows quickly through the town, till it throws itself in a single mass over a precipice 100 feet high, and rushes through a chasm of the rock, into a deep cavern below, called La Grotta di Nettuno. A fine Corinthian temple, supposed to have been dedicated to Vesta, crowns the summit of the precipice. Only ten of its eighteen columns remain, with their entablature. Near this temple are four pillars of another temple, forming part of the wall of a modern church. In the vacancy are the remains of several Roman villas, particularly that of Adrian's villa, of great extent and magnificence. There are five freestone quarries in the neighbourhood, and the waters of the Teverone form, by their calcareous deposits, the Tiburtine stone. Population about 14,000.

TLASCALA, or Tlaxcalla, (the *land of bread*,) a government of Mexico, in the intendancy of Pueblos los Angelos. It is about 354 miles long, and from 40 to 150 broad. The great chain, called the Cordillera de Anchuac, passes through the province for about 18 leagues in the west, and a range of mountains, covered with snow, crosses it on the north. The climate, soil, and productions, are the same as those of Mexico, which we have already described under that article.

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* Tir-Ii, Land of Ii or Iona, to which it belonged.

Tlaxcalla, the capital, is built on the side of a high mountain, on the banks of a river which flows into the Pacific. It is said to have once contained 300,000 inhabitants, but they now amount only to 3400, of whom only 900 are Indians. The population of the province in 1793 was 59,177, of whom 21,849 were males, and 21,029 female Indians. The capital stands in W. Lon. 98° 30′, N. Lat. 19° 45′.

TOAD. See Herpetology, Vol. X. p. 400—401.

TOBACCO, (*Nicotiana* in botany,) is the vulgar name of a plant of stimulating and narcotic properties. It is said to have been first imported into Europe by Sir Francis Drake, about 1560, and to have derived its name from Tabaco, a province of Yucatan, where it was first found, or, as others say, from the island of Tobago. It received the name of *nicotiana*, or the *ambassador's herb*, from John Nicot, then ambassador from Francis II. to Portugal, who brought it from Lisbon, and presented some of it to Catherine de Medicis, and to a grand prior of the house of Lorraine, whence it received the name of *Queen's herb* and *Grand Prior's herb.*

According to Lovel, tobacco was cultivated in Great Britain before 1570, and the smoking of it is said to have been introduced by Sir Walter Raleigh, about 1586. See our article Materia Medica, Vol. XII. p. 430.

TOBAGO, one of the Carribee Islands in the West Indies, belonging to Great Britain. It is about 25 miles long, and its greatest breadth is 12 miles. It was discovered by Columbus in 1498. About 1632 it was colonized by the Dutch, under the name of New Walcheren. The N.W. extremity of the island is mountainous, but though its surface is unequal, yet no part of it is rugged or impassible. The soil is rich, and the island abounds with springs. It possesses numerous bays and creeks, many of which afford anchorage for vessels of 150 tons, while Halifax bay admits ships of 250 tons. The climate is more temperate than its proximity to the equator would lead us to expect, and it lies out of the line of the hurricanes that desolate the West Indies.

Tobago possesses almost all the plants that grow in the Antilles, and also those that are peculiar to Spanish Guinea. The most important of these are Indian corn, Guinea corn, peas, beans, figs, pine apples, pomegranates, oranges, lemons, limes, plantains, bananas, grapes, guavas, tamarinds, prickly pears, papas. The cocoa tree grows in great perfection. The animals in the island are wild hogs, peccaros resembling swine, armadillos, guanoes, badgers, and Indian rabbits. Horses, cows, deer, asses, sheep, and goats, have multiplied greatly, and were probably introduced by the first settlers. Among the birds which frequent the coast, are herons, the pouched pelican, eagles of the Orinoco, and flamingoes. Among the indigenous birds are three varieties of humming birds, blackbirds yellow and black, white woodcocks, and a bird of the size of the sparrow, having its head and neck of the most beautiful red, the feathers of its wings and tails of a fine purple above, while underneath they are of a sky-blue color like its belly. In 1810, the exports of this island amounted to *l*70,787, and its imports to about *l*200,000. West Lon. 60° 30′. N. Lon. 11° 16′.

TOBOLSK, the western government of Asiatic Russia, includes the extensive tracts watered by the Obi, the Irtysch, and the Yenisei. It is bounded on the north by the Northern Ocean, on the west by the Uralian mountains, which divides it from European Russia; on the south by mountains and deserts, which divides it from China and Independent Tartary, and on the east by Tobolsk. This vast country consists partly of the most dismal wastes, partly of steppes covered with saline lakes and marshes, partly of a fine grazing district, and partly by rich arable plains. The steppe of Barabinski is covered with the most luxuriant pasturage, and the district on the Tobel and its tributaries in the lower part of the country yield the most abundant crops of grain, and likewise the middle parts of the Yenissei and Obi. See our article Russia, Vol. XVII.

Tobolsk, the capital, is a large city situated on the Irtysch. The principal buildings are the governor's house, the public offices, the foreign magazine, two churches, and a convent, all of which are built of stone. All the other buildings are of wood. Population about 16,269. East Lon. 68° 15′. North Lat. 58° 12′.

TOBY'S Creek, now more correctly known as Clarion river, a branch of Allegheny river. The remote sources rise in McKean county, Pennsylvania, interlocking with those of Allegheny and of Sinnamahoning, branch of Susquehannah. Flowing by a general course S.W. by W. over Jefferson county, and thence separating Armstrong from Venango, falls into the left side of Allegheny river, after an entire comparative course of 120 miles.

TOCANTIN, river of South America. See article South America, head of Brazil.

TODD, county of Kentucky, bounded W. by Christian, N. by Muhlenburgh, E. by Logan, and S. by Montgomery counties, Tennessee. Length from south to north 36 miles; mean width 17, and area 612 square miles. Extending in Lat. from 36° 37′ to 37° 06′, and in Lon. from 10° 04′ to 10° 22′ W. from W. C. Todd county occupies a part of the summit level between Greene and Cumberland rivers. The northern part slopes towards Greene, and gives source to creeks flowing northwardly into that river. The southern and larger section of the county declines southward towards Cumberland river, giving source to the higher northwestern creeks of Red river.

By the post office list of 1831, Todd county contained five post offices, at the following places: Elkton, the county seat, Allensville, Haddensville, Hopper's Tan Yard, and Trenton.

Elkton, seat of justice for Todd county, is situated on a small branch, called Elk Fork, of Red river, about 60 miles N.W. from Nashville in Tennessee, and by post road 186 miles S.W. by W. from Frankfort. N. Lat: 36° 51′, and Lon. 10° 13′ W. of W. C. Population of the county, 1820, 5089. Darby.

TOLEDO, a city of Spain, in New Castile, situated on the summit and declivity of a steep hill, which is watered by the Tagus on its N. and W. sides. This hill occupies a narrow valley, surrounded with lofty mountains. The alcazar or palace, on the top of a hill, is a solid and magnificent structure, now used as a working establishment for the lower classes. The cathedral is a Gothic building of great magnitude. The hospitals of St. Cruz and St. John are elegant buildings. Besides these there are numerous churches and monasteries. There are here the remains of a Roman circus, a Roman aqueduct, and a Roman road. Population about 20,000. West Lon. 4° 11′. N. Lat. 39° 62′ 24″. See Laborde's *View of Spain.*

TOLLAND, county of Connecticut, bounded by Windham E., New London S.E. and S., Hartford W., and Hamden and Worcester counties in Massachusetts N. Length from south to north 33 miles; mean width 12, and area 396 square miles. Extending in Lat. from 41° to 42° 02′ N. and in Lon. from 3° 09′ to 5° 04′ E. from W. C.

A minor chain of mountains traverses this county in a direction slightly inclining from north to south towards the northeast and southwest. This chain divides the county into two unequal sections. That westward from the mountains declines southwardly, and in that direction gives source to, and discharges Scantic, Hockanum, and Salmon rivers, which find a recipient in Connecticut river. This slope of Tolland contains the five townships of Hebron, Bolton, Vernon, Ellington, and Somers. The opposing, or eastern plain, though falling from a mountain chain which extends from south to north, really declines to the south very nearly, and gives source to the Willamantic and Hop rivers, the constituents of the Shetucket branch of Thames river, and contains the townships of Columbia, Coventry, Mansfield, Tolland, Willington, Stafford, and Union.

In 1831, by the post office list, there were, beside Tolland, the county seat, sixteen post offices, namely, Andover, Bolton, Columbia, Coventry, Ellington, Gilead, Hebron, Mansfield, Mansfield Centre, North Somers, Somers, South Coventry, Stafford Springs, Union, Vernon, and Willington.

Tolland, the seat of justice, is situated on one of the higher branches of Hop river, 17 miles N.E. by E. from Hartford, and 53 miles N.N.E. from New Haven. N. Lat. 41° 52′. Lon. 4° 30′ E. from W. C.

In 1820 this county contained 14,330 inhabitants, and in 1830, 18,806, having gained in 10 years 4,476, or a fraction above 31 per cent.

TOMBIGBEE, river of the United States, in the states of Mississippi and Alabama, rising by numerous branches in the northeastern angle of the former, interlocking sources with the Yazoo and Big Hatchee, flowing into the Mississippi and Bear Creek branch of Tennessee. The extreme sources of Tombigbee are in the Chickasaw territory, about N. Lat. 34° 30′, and 12° W. from W. C. on a rather comparatively elevated plain, from which, flowing a little E. of S. about 100 miles, receiving numerous branches to its entrance into Alabama. For about one half of its course in the state of Mississippi, the Tombigbee separates the county of Monroe from the Chickasaw territory.

Entering the state of Alabama, the Tombigbee, already a navigable river, particularly for down stream vessels, deflects to S.S.E. receiving the Sipsey river from the north, and the Oaknoxabee from the west, continues by a very winding channel, but by comparative courses 60 miles to its union with Black Warrior river at Demapolis in Marengo county. At their junction, the two main branches of Tombigbee are very nearly of equal size, though the name of Tombigbee is continued in the united streams of that river and Black Warrior.

The Black Warrior or Tuscaloosa river rises by two main constituents, Locust Fork, in Blount, and Mulberry in Walker county. Uniting on the western border of Jefferson, after each branch has flown upwards of 70 miles, the now navigable Tuscaloosa continues the course of Locust Fork S.W. 80 miles to its junction with Tombigbee, as already noticed.

Uniting, the two vallies of Tombigbee and Tuscaloosa above their junction yields a surface approaching an equilateral triangle of 160 miles each side; but taking in the projecting curves, the area is about 14,000 square miles.

In that part of its course in Alabama above the influx of Tuscaloosa, the main stream of Tombigbee separates the counties of Pickens and Greene from the Choctaw territory. Below Demapolis the Tombigbee, by a slight elliptical curve to the westward, flows by a general comparative course very nearly due south 100 miles, to its junction with the Alabama, to form Mobile river. The entire length by Tombigbee proper is about 270, and by Tuscaloosa 240 miles. These distances are, however, comparative bird's eye estimates. The actual channel is very tortuous, and may add one-third or more to the navigable modes of calculating river lengths.

If viewed geographically, the Tombigbee valley extends from N. Lat. 31° 06′ to 34° 45′, and in Lon. from 9° 24′ to 12° 24′ W. from W. C. It has the valley of Yazoo and that of Big Hatchee N. W., Tennessee N., Coosa, Cahaba, and Alabama N.E., E. and S.E., and those of Pearl and Pascagonla S.W. Entire area 18,000 square miles. Darby.

TOMBUCTOO, or Tembuctoo, a celebrated city of Central Africa, is said to have been founded in 1216 by Mense Soliman. It has always been the emporium of the trade of Central Africa, and as it has never been visited by any European traveller or merchant, it has excited a curiosity which is now beginning to subside. The accounts of the size and magnificence of Tombuctoo have been greatly exaggerated; and when we compare the latest notices of it obtained by Captain Lyon, with the earlier accounts published by Mr. Jackson in his account of Morocco, we can scarcely avoid coming to the conclusion, that Tombuctoo will dwindle down into an African city of ordinary dimensions.

According to Mr. Jackson, Tombuctoo is situated in a plain, about 12 miles north of the Niger; is 12 miles in circuit, is surrounded by sandy eminences, and has no walls. The houses are spacious, and of a square form, with an opening in the centre, towards which the doors open, and have in general no upper apartments. Close to the entrance door is a building consisting of two rooms, called a *duaria*, in which visitors are received and entertained, in order that they may not see the women, who are very handsome. The accommodation for travellers consists of a large house, with an open space in the middle, round which are rooms sufficient for containing a bed and a table. The profits on the trade to this place were said to be so great, that $5000 invested in European commodities at Mogadore, in Fez, would produce in one or two years a return of 20,000*l.*

An American sailor of the name of Adams, who was wrecked on the eastern coast of Africa in 1810, and detained three years in slavery by the Arabs of the great desert, says that he resided several months in Tombuctoo, and he published in London in 1816 a narrative of his adventures. He describes the city as occupying nearly as much ground as Lisbon, but without walls and fortifications. The houses were not continuous. They consisted of a ground floor merely, were built with sticks, clay, and grass, and were furnished with the rudest domestic implements. The palace consisted of 8 or 10 small rooms on a ground floor, not even white washed, and built of clay and grass. Adams saw no shops at Tombuctoo. The articles of trade consisted principally of tobacco, tar, gunpowder, blue nankeens, blankets, earthen jars, and some silks. He states, that the city stands on a level plain, having a river about 200 yards from the town, on the south east, called La Mar Zarah, and 3-4ths of a mile wide.

The information more recently obtained through Captain Riley, an American, who was shipwrecked in 1815 on the coast of the Sahara, seems quite at variance with that of Adams. He obtained it from an African merchant, Sidi Hamet, by whom he was purchased and brought to Mogadore. Hamet described it as a large place, six times more populous than Mogadore. The population is entirely negro, and no mussulman is allowed to enter, unless 50 at a time from each caravan, and unarmed. But there is a distinct town, he says, which formed the residence of the mussulmen who were permitted to remain at Tombuctoo. It is separated from the other by a slim partition wall. A strong wall of stone and clay encircles the city, which is entered by four gates which are closed at night. The palace consists of the same materials as the wall, and is lofty and of considerable extent. The houses are chiefly built of reeds, though there are several of stone. A small river runs close to the town, but the Zolibib (Joliba) a large river, is at the distance of an hour's ride of a camel.

The most recent account of Tombuctoo is that of Captain Lyon, collected from the African merchants during his residence in Fezzan. According to him the town is walled; the houses very low, and with the exception of one or two wide streets, irregularly built. The greater part of the habitations are mere huts made of mats. The immense population ascribed to the city is supposed to have included the Kaffles from Morocco, Ghadame and Nibole, who arrived there in great numbers, and erected temporary huts, when compelled to remain during the rainy season, or till their merchandise is sold. In this way 10 or 15,000 inhabitants are apparently added to the population. Its port, called Kabra, about 12 miles to the south of it, was more a collection of storehouses than a town. The Nil or Joliba is there very broad. The trade consists in gold from Jenne, cotton cloths, leather and arms made in Tombuctoo and the surrounding villages. Tombuctoo has a language of its own, of which Captain Lyon has given a vocabulary. Tombuctoo is governed by a king or sultan, who possesses but little power. The city is about 90 days journey from Mourzouk, and the road thence is through Tuat. Several merchants agree in saying that the city is not larger than Mourzouk. It is distant from Downes, a large town or district on the Nil (Goulbi or Joliba) one day and a half east.

From these various statements it evidently appears that Tombuctoo is a place of ordinary size, and ordinary interest, which the cupidity of merchants, and the imaginations of travellers have exalted into the Eldorado of Africa. Distance from the mouth of the Senegal about 1100. East Lon. 1° 20′. North Lat. 17°.

For farther information on this subject, see Jackson's *Account of the Empire of Morocco*, Chap. XIII. p. 237. Lond. 1809. Adam's *Narrative*, London, 1816, and Captain Lyon's *Narrative of Travels in North Africa*, p. 144—146, Lond. 1821. See also our articles Africa Vol. I. p. 185, and Morocco, Vol. XIII. p. 786.

TOMPKINS, county of New-York, bounded by Seneca county N.W., Cayuga N., Cortlandt E., Tioga S., and Seneca Lake separating it from Steuben county W. Length from east to west 30; mean width about 20, area 600 square miles. Extending in Lat. from 42° 17′ to 42° 38′ N., and in Lon. from the meridian of W. C. to 0° 36′ E.

The south side of Tompkins touches the dividing ground between the sources of Cayuta and Oswego Creeks, flowing southwardly into Susquehannah River, and those of Catherine's Creek flowing into Seneca Lake; Ithaca Creek entering the head of Cayuga Lake, and Owasco Creek flowing into Owasco Lake. The surface of the county is with but little exception hilly, indeed might be called mountainous, though the relative level is very different. The arable surface along the southern side of the county exceeds an elevation of one thousand feet above the ocean level. The level of Seneca Lake is nearly four hundred and forty feet. Cayuga is a few feet lower, but no part of the county falls below 420 feet relative oceanic level.

The soil is very productive in grain, grasses, and fruit. The climate is sensibly effected by difference of height. The seasons of harvest, and the ripening of fruit, is not earlier, if so early, as on the margin of lake Ontario, a degree of latitude more northwardly.

By the post office list of 1831, there were 31 post offices in this county, at the following places: Bensonville, Burdette, Caroline, Cayuga Inlet, Danby, Dryden, Enfield, Etna, Fall Creek, Groton, Hector, Hector Falls, Ingersoll's store, Ithaca, the county seat, Jacksonville, Lansingville, Logan, Ludlowville, MacLean, Macklinburgh, Newfield, North Hector, North Lansing, Peruville, Reynoldsville, Scarsburgh, Slaterville, South Lansing, Trumansburgh, Vernon, West Dryden.

Ithaca, the seat of justice, Tompkin's county, stands on a point above the junction of two branches of Falls Creek, about two miles southward from the head of Cayuga Lake, 28 miles N.N.W. from Owego on Susquehannah, about 40 very nearly due N. from Athens in Bradford county, Pennsylvania, and by post road 290 miles from, and only 22 minutes E. of W. C. N. Lat. 42° 28′.

Ithaca is a very flourishing and commercial village, situated in a fine, well cultivated and picturesque vicinity.

Population of the whole county in 1820 was 20,681. Darby.

TOMSK, the name of a government in Siberia, comprehending a great part of the districts situated on the Oby and the Yenisei. The capital of the same name is situated on the right bank of the Tarn, about 25 miles from its junction with the Oby. The greater part of the town is built at the foot of a mountain. The streets are narrow and crooked, and the houses out of line. The new part of the town contains more regular streets and better houses. Within the ruins of the Kremlin are the cathedral, the public offices, and the magazines for the tribute furs. The church of the Resurrection and two convents are the principal buildings out of the Kremlin. Population about 8000. East Lon. 85° 14′, N. Lat. 56° 30′. See Russia, Vol. XVII. p. 496, 497.

TONGA, and TONGATABOO. See Friendly Islands, Vol. IX. p. 461.

TONNEWANTA, river of New-York, the most remote sources of which are in the southern side of Genesee county, interlocking sources with those of Cattarangus river, Buffaloe Creek, and Wiscon Creek of Genesee river. Flowing thence a little east of north, by comparative courses, twenty-five miles to Batavia, the seat of justice for Genesee county. Here it inflects to N.W. by W. 14 miles to the boundary line between Genesee and Erie and Niagara counties. Again inflecting, and by a comparative course of 25 miles a little S. of W., falls into that channel of Niagara river which runs round the eastern side of Grand Island. In the lower part of its course Tonnewanta separates Niagara and Erie counties, and for the lower 11 miles serves as the channel of the Erie canal. Though elevated above lake Ontario from three to four or five hundred feet, the channel of Tonnewanta below Batavia has the appearance much more of a bayou of Lower Louisiana, than that of a river on the table land of western New York. Darby.

TONQUIN. See Tungkin.

TOOFOA. See Friendly Islands, Vol. IX. p. 462.

TOOKE, John Horne, a celebrated English author, was born in Westminster in June 1736, and was the third son of a poulterer in Newport market. From Westminster school he went to Eton, where he remained five or six years, and at which he lost one of his eyes. In 1755 he entered St. John's College, Cambridge, where he took his degree of B. A. After officiating as usher in Mr. Jenning's school at Blackheath, he took doctor's orders, and obtained a curacy in Kent. His preference, however, of the law led him to enter as a student at the Inner Temple in 1756; but he was induced in 1760 to take church orders, and he preached for three years in the Chapelry of New Brentford, which his father had purchased for him. He afterwards accompanied to France the son of Mr. Elwes the celebrated miser.

His political life began in 1765, when he defended Wilkes and his friends in an anonymous pamphlet, entitled *The Petition of an Englishman*, and on his return to Paris he had an opportunity of making the acquaintance of that celebrated demagogue. A quarrel, however, again separated them in 1770, which arose out of some pecuniary transaction connected with the society which Horne had established for supporting the bill of rights. In 1771 our author took his degree of M.A. at Cambridge, in doing which he was opposed by some of the members of the University, among whom was Mr. Paley. About this time he made great exertions to have the debates in the House of Commons published in the daily papers, and his success was doubtless owing to the aid he received from Wilkes and Almon. In 1771 Mr. Horne was attacked by Junius, to whom he replied in two very able letters, which are published in the works of that mysterious name. In 1773 he formally resigned his living, and devoted himself to the profession of the bar. An accident, however, now occurred which influenced his future fortune. Mr. Tooke of Purley in Surry, had made an ineffectual opposition to an inclosure bill which was passing rapidly through the house, and which he regarded as highly injurious to his estate. In this emergency he consulted Mr. Horne, who recommended the strange remedy of a libel upon the Speaker, which he undertook to write. It accordingly appeared in the Public Advertiser. As the avowed author of it, Mr. Horne was called to the bar of the House, and he respectfully acknowledged that his hatred of oppression and his zeal for a friend had led him beyond the limits of discretion. He was placed in the custody of the Sergeant at Arms for some days, and finally discharged on paying the fees. Time was thus obtained for reconsidering the obnoxious bill, and it is said that some of the exceptionable clauses were either modified or cancelled. Mr. Tooke's gratitude for his friendly services induced him to hold out to him the prospect of testamentary remuneration; and in consequence of this Colonel Harwood, the nephew of Mr. Tooke, agreed with Mr. Horne to divide equally their joint interest in the reversion of the estate of Purley. According to one of his biographers this division took place, but according to others, Mr. Horne never received more than £8000 from the property, (though he adopted the name of Tooke in 1782) the principal legatee being a Mr. Beaseley.

Mr Horne was, as might have been expected, a keen opposer of the American war, and when the constitutional society voted £100 to the widows of the Americans who fell in the battle of Lexington, the fact was announced in an advertisement signed John Horne, in which the sufferers were denominated "Englishmen who, preferring death to slavery, were, for that reason only, inhumanly murdered by the king's troops." For this libel he was tried at Guildhall in 1777, and notwithstanding the ability of his defence, he was fined £100 and imprisoned twelve months.

Mr. Horne's acuteness as a grammatical critic first appeared during this trial, and in 1778 he published a letter to Mr. Dunning to investigate the meaning of certain conjunctions and prepositions used in his indictment. In 1779 the society of the Inner Temple refused to admit him to the bar, on the ground of his being a clergyman. Exasperated at this disappointment, he wreaked his vengeance on the government, and in 1780 he published a pamphlet entitled "Facts," containing a severe review of Lord North's administration, and including two chapters on Finance by Dr Price. In 1782, when the topic of parliamentary reform became popular, he addressed to Lord Ashburton (Mr. Dunning) "A Letter on Parliamentary Reform, containing the sketch of a plan."

In 1786 he published his great work under the title of Επεα πτεροεντα, or *Diversions of Purley*, from the residence of his friend Mr. Tooke. This work, consisting of a number of grammatical dissertations, was founded on his first letter to Mr. Dunning, and has gained its author a high name among modern philologists.* In 1787 he published a *Letter to the Prince of Wales*, on his supposed marriage with a catholic. In 1788 he printed a political pamphlet entitled "*Two Pair of Portraits*," in reference to the two Pitts and the two Foxes. His object was to serve the cause of Mr. Pitt.

In 1790 Mr. Horne Tooke opposed Mr. Fox and Lord Hood as a candidate for Westminster, and he polled 1700 independent votes. In 1794 he was tried for high treason and acquitted, as we have already seen in our history of BRITAIN, Vol. IV. p. 640.

In 1796 Mr. Horne again became a candidate for Westminster, and polled 2819 votes; and in 1801 he took his seat in the House of Commons as member for Old Sarum, in the gift of Lord Camelford. A question arose whether a clergyman could sit in the house; but Mr. Addington brought in a bill to determine the future ineligibility of clergymen, and Mr. Tooke retained his seat till the dissolution of the parliament.

In 1802 he published the second part of his *Diversions of Purley*, which relates principally to etymology, and to the formation of adjectives and participles.

His last political act was his support of Mr. Paul as candidate for Westminster, but he afterwards saw reason to abandon him.

The last years of Mr. Tooke's life were spent in easy circumstances, and in a select circle of friends, whom he entertained with great hospitality at Wimbledon, where he died in March 1812, in the 77th year of his age. He was buried in Ealing church, and not in his garden, as he directed, and his property was left to his natural daughters.

Mr. Tooke was remarkable for the wit and vivacity of his conversation, and for the grace, frankness, and dignity of his manners.† His fund of anecdote was inexhaustible, his sense of the ridiculous was keen, and his powers of raillery formidable. In the bodily suffering which preceded his death, he displayed great composure, and even cheerfulness, and he exhibited as has been well observed, in his last hours, a "manly spirit and a practical philosophy, which if they had been brought to bear upon his moral as well as upon his physical condition, if they had been employed with as much effect in reconciling him to his political exclusion as to his bodily sufferings, might have produced, not the very imperfect character we have been attempting to delineate, in which the unfavourable traits bear a larger proportion to those of a nobler and more benign cast, but the venerable portrait of a truly wise and virtuous man." See Reid's *Memoirs*, 8vo. Lond. 1812, Shepherd's *Memoirs of John Horne Tooke*, 2 vols. 8vo. Lond. 1813. This work contains many of his letters. *Quarterly Review*, Vol. vii. No. xiv. and Chalmers's *Biographical Dictionary*, vol. xxix.

TOPAZ. See MINERALOGY, *Index*.

TOPICAL DYEING OR CALICO PRINTING, is the art of printing various coloured patterns upon plain calicoes by applying certain colourless mordaunts to the cloth.

This beautiful art is one of great antiquity, and was carried to considerable perfection in India. As the object in this brief sketch is not to instruct the calico printer, but to give the general reader an idea of this singular art, we shall omit all the previous processes of preparing the calico for the printer.

The pattern to be impressed on the calico was formerly cut out in relief on a wooden block of the requisite size, exactly like a wooden cut for figures or diagrams. The wood used was generally holly, and the cutting of the pattern formed a separate trade called block-cutting. The perishable nature of wood, however, involved the printer often in much expense, and hence a great improvement has taken place by using slender pieces of brass or copper, which are fixed on the wood so as to produce the pattern, and which give greater sharpness and precision to the impressions. The next implement is the sieve with its case. The sieve consists of a broad hoop like that of a tambourin with a piece of superfine woollen cloth stretched tightly across it. The case consists of another wider hoop covered with sheep skin or oil cloth. The sieve placed in its case is now plunged in a tub of gum water.

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* See our article GRAMMAR, Vol. X. for an account of his philological views.

† Mr. Horne, when a boy, was admitted once or twice a week at Leicester House as a playfellow to George III.

The mordaunt mixed up with paste made of flour or a thick solution of gum Arabic, or gum Senegal, or gum nigacanth, is then spread with a brush on the cloth of the sieve, a part of the process which is called *teesing*. When the mordaunt is colourless, as the acetate of alumine, a little purple dye with a decoction of Brazil wood is mixed up with it to *sighten* it as the workmen say, or to make the pattern apparent to the eye.

The workman now takes the pattern block in one hand and the sieve in the other, and applying the surface of the block to that of the sieve, he then takes up a sufficient quantity of the thickened mordaunt so as to cover every part of the surface of the pattern formed by the copper lines. He then applies the block to the calico and impresses it with a gentle blow from a mallet. In this manner he goes over the whole piece. When a variety of colours is required, several different mordaunts are required, as different colours require different mordaunts to fix them. In order to evaporate the acids of the mordaunts, which might weaken the fabric of the cloth, the calico is placed in a room called the stove, heated with flues to about 90°. When the common red liquor mordaunt is used, the calico remains here about 24 hours; but when citric acid is used, a much shorter time is nesessary, and when a strong muriate of lime has been employed, half an hour of the stove is sufficient.

When iron liquor is the mordaunt, the intensity of the colour is increased, and the process much improved by exposing the calico for several days to the atmosphere. The black oxide of iron then acquires an additional dose of oxygen, and approaches nearer to the red or peroxide, which is the preferable mordaunt. Mr. Parker suggests it as an object of inquiry, whether or not the substitution of a current of atmospheric air for a great part of the drying in the stove, might not be an advantage.

The calico is now washed with water and a little cow dung, at various temperatures, an operation of from 5 to 40 minutes, which revives the uncombined part of the mordaunt, and which is now performed in what is called dunging machines. Mr. Parker is of opinion, that the dung, (which Bethollet found to contain a substance like bile,) imparts an animal matter to the fibres of the calico, which acts as an additional mordaunt.

When the goods are perfectly rinsed in river and tepid water, they are boiled for ten or fifteen minutes in madder, and in the process called *maddering*, the calicoes receive, at one operation, all their requisite colours. The colouring matter of the madder is precipitated to a *red* by one mordaunt, to a *purple* by another, and to a *black* by a third, so that we can obtain every possible shade, from a *lilac* to a *black*, or from a *pink* to a *red*.

By adding to the madder some weld or bark, every shade from a *brown* to an *orange* may be produced, and with weld or bark, also, we obtain all colours from a *dark olive* to a *bright lemon*. In order to produce the finest yellow or delicate lemon colour, the calico should be dried in the open air, as stove drying converts a yellow to an orange, and the dunging should not be performed at a higher temperature than 96° or 100°.

The calicoes are next to be *branned*, an operation which is effected by removing them from the weld or madder copper to a boiler containing wheat bran and water, in which all stains are cleared from the white portion, though at the risk of the colours being somewhat impaired. Mr. Parker has found that a peculiar redness may be imparted to all madder colours, by raising them with a mixture of bran and madder, that is, by adding a little bran to the madder, in the maddering process.

As the whites cannot always be cleared by the branning, lest the colours should be impaired, the rest of the operation of bleaching the whites is performed by exposure on the grass for some days; but in Scotland, this process has been effected in a few minutes, by immersion of the colours in a weak solution of one of the bleaching salts, such as oxymuriate of potash, soda, and magnesia.

The mordaunts used by the calico printers are commonly *acetate of iron* for *browns, blacks, lilacs*, &c. and *acetate of alumine* for all shades of *yellows* and *reds*, &c. *Nitrate of iron*, obtained by dissolving metallic iron in a peculiar kind of aquafortis, yields blacks, which, like those obtained from galls, are applied at once to the cloth, and are not afterwards raised by dying, like the black of the common iron liquor. Hence the black of the nitrate of iron can be mixed with other colours.

Another kind of calico printing, called *resist work*, is now in common use. A resist paste is composed of sulphate, nitrate, muriate, or acetate of copper, of which the sulphate is the best, mixed with flour paste, or any of the other gums, or with pipe-clay and gum. With this paste the pattern is printed on the calico, which when sufficiently dry is repeatedly dipped in the blue vat, till they have received the requisite depth of tint. The goods are then washed and passed through diluted sulphuric acid, and all the parts printed by the preparation of copper are found to be of a good white, in consequence of having resisted the action of the indigo, though all the rest of the calico has been permanently dyed. The deep blue calicoes, with white figures or white spots, are generally executed by the resist process with indigo; and by a peculiar method, with subsequent dying or madder, weld or bark, red or yellow spots or figures may be produced upon a blue ground.

A method of resisting, or stopping out particular colours with wax, though an expensive one, was formerly in general use, and wax is still employed in India for preserving the white portions. In the manufacture of silk Bandana handkerchiefs, a preparation of tallow and rosin, made fluid by heat, is used for printing the patterns, which are thus left white, and preserved from the operation of the indigo, which gives the rest a blue colour.

When the ground is to be white, and only a single sprig or small object is to form the pattern, it is executed by means of a pencil, with what is called pencil blue, which is formed of 10 oz. of finely ground indigo, 20 oz. of quick lime in lumps, 20 oz. of potash of commerce, and 10 oz. of orpiment, mixed up in a gallon of water, and thickened with gum senegal.

In another operation of calico printing, called chemical discharge work, the goods are dyed of one uniform colour, with a mixture of iron liquor, and any of the dyeing substances. When they are washed, dried, turned, and calendered, a discharging liquor is prepared by dissolving in one of the mineral acids a portion of one or more of the metals, according to the nature of the colour to be discharged, or of that to be produced. For example, if a piece of calico, treated with a decoction of Brazil wood, and dyed black by being maddered with iron liquor, be printed when dry, with a peculiar solution of tin, the iron in the dye will be dissolved, and the printed part will instantly be converted from a deep black into a brilliant crimson.

The introduction of cylinder printing into the calico manufacture, is a most important step in its progress. Cylinders from 18 to 42 inches long, and from 3½ to 5 inches wide, are now formed by hammering plates of copper into a circular form, though sometimes they are bored out of a solid mass of copper. The pattern is enchased on the surface. The cylinders furnish themselves with colouring matter, placed in a trough, and are kept clear by a steel knife, called the *doctor*, which passes over the surface, when they are charged with the thickened colour. The cylinder, thus coloured, rolls over the piece of calico, from one end to the other, and communicates the pattern with the greatest certainty and accuracy. Sometimes two cylinders are used to give two different colours at the same time. Mr. A. Parkinson of Manchester, has invented a machine, on which one cylinder and two surface rollers give three distinct colours.

Other machines have been employed, called *surface machines*. They consist of cylinders of wood, with the pattern formed upon them, exactly like the pattern blocks already described. By means of those cylinder machines, a piece of calico, which employs a man and a boy *three hours*, may be done in *three* or *three and a half minutes*.

Hence the British calico printer has been able to finish calico goods, in which the printing consists of precipitating the colouring matter of logwood and other vegetable dyes, without using any mordaunt or previous preparation whatever, at the rate of *one penny per yard*, including every expense of colour, paste, and printing. In such goods, the pattern will be washed out by the first shower of rain. For a full account of topical dyeing in calico printing, the reader is referred to Parke's *Chemical Essays*, from the information contained in which we have drawn up the above brief article. See also our article Bandana Handkerchiefs, Vol. III. p. 213.

TORNADO. See Physical Geography, Vol. XV.

TORPEDO. See Ichthyology, Vol. XI. p. 118—141, and Electricity, Vol. VIII. p. 296, 301.

TORRICELLI Evangelista, a celebrated natural philosopher, was born at Faenza in 1608. His discoveries, which have already been detailed in our articles Barometer and Pneumatics, are recorded in his *Lezioni Academiche*, which appeared at Florence in 1715, with a life of the author, by Buonaventuri. He was appointed mathematician to the Grand Duke Ferdinand II., and he filled also the mathematical chair of Florence. He died in 1647, in the 39th year of his age. See our article Mathematics.

TORTOISE. See Herpetology, Vol. X. p. 382—385, and the *Edinburgh Journal of Science*, Vol. 1829, No. ii. p. 244, New Series.

TOULON, a seaport town of France, and capital of the department of the Var. Its form is oval, with its greatest length parallel to the sea, and it stands at the foot of a ridge of lofty mountains. It is defended by ramparts, ditches, bastions, batteries, and by a fine citadel. The old town is ill built, but has a long street called *Rue aux arbres*. The new town, where the public buildings were erected by Louis XIV. contains several square streets, and the oblong square, called the Champ de Bataille, surrounded with a double row of poplars. The principal public buildings are the Hotel de Ville, the Hotel de l'Intendance, and several churches and hospitals.

As one of the principal stations of the French navy, Toulon has excellent harbours, viz. the new harbour and the merchants' harbour. The former can contain 200 sail of the line. The latter is a commodious though small basin, surrounded by a handsome quay. The entrance from the roadstead to the harbours is defended by two strong forts. The arsenal, which stands round the new harbour, is a large building filled with naval stores, every man of war having its own particular storehouse. It contains shops for carpenters, blacksmiths, &c. The rope-house, built entirely of freestone, is 320 feet long, with three arched walks. There are here also docks for ship-building, the dry dock being particularly interesting. The galley slaves, about 5000 in number, are kept at work at Toulon.

The trade of this place is confined to the productions of the vicinity, such as wine, oil, silk, and fruit, particularly capres, of which at least 2000 quintals used to be annually exported. The principal manufactures of the place are woollen goods, soap, glass, hats, and caps. There is here a herring fishery on a large scale. Population 22,000, exclusive of the galley slaves. For an account of the siege of Toulon in 1793, see Britain, Vol. IV. p. 639. East Lon. 5° 55′ 41″. North Lat. 43° 7′.

TOULOUSE, a large town in the S. of France, and the capital of the Upper Garonne. It stands on the right bank of the Garonne, which is here navigable, and has been described as "a labyrinth of narrow and winding streets." Some of the streets, however, are tolerably broad, though the squares are all very small. The principal public objects are the town-house, called the capital,[*] which stands in the Place Royale, and has a fine façade, the ancient archbishop's palace, the cathedral, the mint, the exchange, the hospital, the theatre, and the bridge above the Garonne, which is a grand structure, 830 feet long and 72 broad. It is partly built of stone and partly of brick. In one of the halls of the town-house are the busts of all the eminent natives since the time of the Romans. Among the antiquities of Toulouse, are the remains of an amphitheatre and some vestiges of an aqueduct. There is here an university with a library, museum, botanical garden, and observatory. There is also an academy of arts and sciences, an academy of inscriptions, and a central school. In the caverns of the church of the Cordeliers there used to be exhibited dried dead bodies arranged along a wall. The chief manufactures of the place are silk, woollen and linen goods, carpets and cotton, and there is also a foundry for cannon. An account of the battle of Toulouse has been already given in our article FRANCE, Vol. IX. p. 374. The population of Toulouse in 1822, was 52,328, and in 1827, it was no less than 69,731. East Lon. 1° 26′ 36″. North Lat. 43° 36′ 46″.

TOURMALINE. See MINERALOGY *Index*, ELECTRICITY, and SCIENCE, *Curiosities in*, Vol. XVI. p. 615.

TOURNAY, the *Civitas Nerviorum* of the Romans, is a large town of the Netherlands, built on both sides of the Scheldt. The town is gloomy and ill built. The chief buildings are the cathedral, the Abbey of St. Martin, and an hospital. There are also a lyceum, a central school, and a public library. There is a handsome quay along the Scheldt. The manufactures are woollen and cotton goods, carpets, stockings, and crape. Population 12,000.

TOURNEFORT. See BOTANY, Vol. IV. p. 12—13.

TOURS, a town of France, and capital of the department of the Indre and Loire. It stands in a fine plain on the left bank of the Loire, a little above its junction with the Cher. Its form is oblong. The old part of the town consists of narrow and gloomy streets, but the new part, built in the reign of Louis XVI., is very handsome, containing the *Rue Neuve* or *Royale*, a very elegant street, and built of fine stone on an uniform plan. This street is on a line with the famous bridge over the Loire, which is 1335 feet long and 45 broad, having 14 arches, each 75 feet in span. The great promenade, called the *Mall*, about 2660 yards long, extends from this bridge to that over the Cher. The cathedral, a metropolitan church, is a fine Gothic structure, with grand spires, an ingenious clock, and a library. The other public buildings are the Hotel de Ville, the Hotel de l'Intendance, the theatre, the archbishop's palace, the church of St. Martin, the college of the Jesuits, and the Benedictine abbey. There is likewise here a museum, a botanical garden, and a race course. The ancient abbey of Marmoutier is in one of the suburbs. It is an immense edifice of an irregular but imposing architecture. It has five terraces which command fine views. The manufactures of this place are silk and woollen goods, leather, wine, and brandy. The red wine of Tours is celebrated. Population 22,000. East Lon. 8° 40′ 38″. North Lat. 47° 23′ 46″.

TRACHEOTOMY. See SURGERY, Vol. XVII.

TRADE WINDS. See PHYSICAL GEOGRAPHY, Vol. XV., p. 579.

TRAFALGAR, BATTLE of. See BRITAIN, Vol. IV. p. 655.

TRAGEDY. See DRAMA, Vol. VII. p. 699.

TRAJAN. See ROME.

TRANSYLVANIA.

TRANSYLVANIA, a country in Europe, and part of ancient Dacia, lies between 47° 37′ 32″ and 45° 33′ 55″ of North Lat. and 43° 47′ 30″ and 40° 26′ 34″ East Long. and contains 880 square miles,[†] including the military cordon. Its Hungarian appellation *Erdely*, or its Latin synonyme Transylvania, intimates its relative situation with respect to Hungary, from which it is separated on the north and west by immense forests; and its limits on the south and east are clearly defined by a chain of lofty mountains, which divide it from Wallachia and Moldavia. With these provinces it has no way of communication but by some narrow defiles, capable of an easy defence, the most celebrated of which is the pass of *Rothenthurn* or the Red Tower, near the village of Boitza. The road through this pass was formed at considerable expense in 1717, by the orders of the Emperor Charles VI., and in many places is cut out of the rock along the banks of the Alt. Dr. Clarke describes it as one of the most remarkable passes in Europe, if not in the whole world; and might be rendered impregnable, simply by throwing down the shelves or artificial wooden roads which, in many parts of it, hang from the sides of the rock, and offer the only means of access.

This country may be divided according to the situations of the three principal nations which are represented in the Transylvanian diet. The Hungarians possess the northern and western parts; the country of the Seklers extends along the eastern frontiers; and the lands in the south belong to the Saxons. The Wallachians, though the most numerous, have no particular territory assigned to them; but they prevail in the central and eastern districts. The subdivisions are enumerated in the following table.

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[*] Here the aldermen are called *capitouls*.

[†] The Hungarian square mile is equal to 16 English square miles.

Hangarian Counties.		*Jurisdiction of the Saxons.*	
Lower Weissenburg.	Free and Royal towns, 4 Burghs, 40 Villages, 1929 Prœdia, 12	Hermanstadt.	Free & Royal towns, 6 Burghs, 13 Villages, 241
Upper Weissenburg.		Mediasch.	
Dobok.		Reismarkt.	
Hunyad.		Reps.	
Klausenburg.		Muhlenbach.	
Kraschna.		Schassburgh.	
Kokelburg.		Gross-Schenk.	
Szolnok *inland.*		Broos.	
——— *central*		Leschkirch.	
Thorda.		DISTRICTS.	
DISTRICTS		Bistritz.	
Fogarasch.		Kronstadt.	
Kœvar.			

Districts of the Seklers.

Aranyosch.	Free and Royal towns, 1
Tchik.	Burghs, - - - 10
Haromszek.	Villages, - - - 411
Maros.	Prœdia, - - - 12
Udvarhely.	

Transylvania presents a very unequal surface; and besides the mountains which form its frontier, there are a great number in the interior of a considerable height, and covered with wood. The principal of these on the north are parts of the great Carpathian chain, which runs from the Black Sea as far as Silesia, and those on the south are, for the most part, fertile hills, producing vines and grain, equally with the plains. Among the highest on the frontiers are, the *Surul*, whose summit is 1078 *toises* above the level of the Alt, which waters its base, and the *Budislaw*, which is 70 toises higher.

Of the immense forests, which formerly covered Transylvania, the most considerable that now remain are those of Ricka, Hargit, Paraide, Mikoane, and Zeidne.

The numerous rivers, which water this province, have their origin within its own territory: and all contribute to increase the waters of the Danube. Of these the chief are the *Maros*, the *Szamos*, greater and less, and the *Alt* or *Aluta*.

The lakes in this country are not confined to the plains, but are found on the heights of the mountains. The principal are, the lake of *Hadosh* or *Tochege*, the lake of *St. Anne*, and the lake of *Piritsch.*

The climate of Transylvania is very variable, and depends greatly upon the direction of the winds, and the cultivation of the country. The changes of temperature are sudden and extreme, and are caused by the frequent storms which ravage this country with great fury, and which are followed by excessive cold. Chilly winds generally prevail in spring and autumn, and are known by particular names, as the wind of *Rothenthurn*, in the country about Harmanstadt; the *Nenenewind* in Haranszek, and the wind of *Thordahaschadek* in the district of Aranyosch. In the eastern and more elevated tracts, the climate is moist, cold and little favourable to the cultivation of grain. During summer the coldest nights are succeeded by scorching heat, and in winter the cold is almost insupportable.

The soil of this country in the plains is, in general, fertile, and produces in great plenty all the necessaries of life. Its mineral riches also are abundant; and besides the precious metals and the more common minerals of marble, slate, lime, granite, chalk, &c. diamonds are found at *Haromszek:* topazes, chrysolites, emeralds, and amethists, on the mountains of *Selis* and *Porkuna;* and agates, opals, calcedonies, and cornelians, in the plains and in the rivers. Mineral waters are more common here than in any other country in Europe, some of which are saline, many metallic, and others produce incrustations and stalactites.

There is no country in the world of the same extent, where so many races of people are assembled together as in Transylvania. Hungarians, Seklers, Saxons or Germans, Wallachians, Bulgarians, Armenians, Greeks, Servians, Bohemians, Poles, Jews and Gypsies. Each of these classes possess a distinct national character; and, though inhabiting the same districts, and often the same villages, they have for ages maintained a stubborn attachment to the customs and usages of their fathers.

The Wallachian language, which is a mixture of Latin and Sclavonian, is the organ of communication among the different nations, as all understand and speak it; but the Hungarians and Seklers, in their intercourse with each other, use always the language of Hungary; and the Saxons the German. Of all these nations the Wallachians are increasing the most rapidly, and may already be calculated at nearly one half of the inhabitants, of which the following table shows their number and proportions:—

Wallachians, - -	800,000
Hungarians and Seklers, - -	460,000
Saxons, - - - -	420,000
Gypsies, - - - -	70,000
Other classes, - - -	14,000
Population, -	1,764,000

The principal towns are *Kronstadt*, containing 25,000 inhabitants; *Klausenburg*, 20,000; *Hermanstadt*, 16,000; *Thorda*, 6,500; and *Udvarhely*, 6000.

Agriculture has made but little progress in this country, and rural economy in general is in a very imperfect state. In the low districts along the banks of the Maros, the Hungarians raise abundant crops; but this is owing more to the fertility of the soil than to the labour of the husbandman. The hardy and intelligent Seklers, who inhabit a higher region, are under the necessity of labouring their fields with greater care; but the best cultivated part of the country belongs to the Saxons, though even they still adhere to the antiquated modes of their ancestors. Transylvania, however, is greatly deficient in agrarian strength; and as it is surrounded by provinces equally fertile in corn, there is little encouragement to agriculture. Wheat is raised in the more fertile districts; and rye, which is chiefly used in the manufacture of spirits, barley, millet, maize, buck-wheat and oats in the mountainous tracts. The culture of potatoes and pulse is much neglected, the Saxons preferring the care of fruit trees and flowers. Tobacco is cultivated to a considerable extent among the Seklers, but it is all consumed in the country.

The most important object of national industry is the working of the mines, which are the richest in Europe, and are an inexhaustible source of wealth to the country. There are above a hundred in actual operation between the Aranyosch and the Maros, which all yield gold mixed with silver. Of these the richest and most productive is that of *Szekerembe*, near the village of Nagyag. The richer ores consist principally of *Tellurium*, which is found in no country in the world but in Transylvania, and contain from 90 to 340 marks of silver per quintal, each mark of silver yielding from six to six and a half ounces of gold, or two-thirds gold and one-third silver. The works are carried on upon a grand scale, and are conducted with a degree of neatness for which the Germans have long been famous in mining. The expense, however, is very considerable, owing to the high wages of the miners, and the dearness of provisions; yet notwithstanding this the mines of Nagyag yield a handsome profit. From the 1st of November 1800, to the 31st of October 1801, they delivered gold and silver ore to the value of 205,572 florins; and the expense of working was 163,632, leaving 41,940 florins of profit. This, however, is not nearly equal to what they formerly produced, as M. Born, who visited them 25 years before, calculated, that in the course of 20 years above 4,000,000 of florins in gold and silver had been cleared by the Nagyag mine. The other mines, though not so valuable, are very productive. The silver ore drawn from the mines of *Vorospatak* yield 328 ounces per quintal, from which is separated nearly two ounces of gold. The mine of *Mala* is remarkable for the richness of the ore, and the beauty of the native gold. Pieces of native gold are often found in the mine of *Orlia* of considerable size; and in 1779 a detached piece was picked up weighing eleven marks. Most of the rivers, and even the brooks formed by the rains contain golden sand; but the richest in this respect is the river Aranyosch. The Wallachians, and particularly the Gypsies, who employ themselves in washing the sands, are said to collect between six and seven quintals of gold yearly, which they are obliged to deliver at a fixed price to the commissioners of government. The mines of salt in Transylvania are numerous and almost inexhaustible. They belong to the crown, and a few only are in operation, which yield annually a million of quintals, of which 800,000 are exported to Hungary.

The arts and manufactures of this province are still in their infancy, and whatever progress they have made is owing entirely to the care of the emperor Joseph II. The blue linen which composes the dress of the Wallachian and Hungarian women formerly came from Turkey; but the emperor having prohibited its importation, this trade was forced upon the inhabitants, and is now in a very flourishing state. Woollen and cotton stuffs are fabricated in considerable quantities, of which a great proportion is exported to Hungary and Wallachia. There are also tan-yards, founderies, paper-mills, glass-houses, and powder-mills. Hats are made at Hermanstadt equal to those of Vienna; and at Kronstadt there is a curious manufacture of a kind of bottle called *tschutten*, which is made of maple-wood soaked in wax. About 30,000 of these are annually sold in Wallachia.

Transylvania depends entirely upon foreigners for articles of luxury. Its commerce in general is rather a transit trade than an exchange of commodities; and this trade is chiefly in the hands of the Greeks and Armenians. The following table will give some idea of its extent:

Imports.	Florins.	Krs.	Exports.	Florins.	Krs.
Cattle - -	759,037	38	Cattle - -	4,980	30
Tallow - -	6,223	10	Tallow - -	2,477	21
Comestibles -	66,231	49	*Comestibles* -	1,452	19
Honey and wax	1,388	25	Honey and wax	13,081	1
Spices and drugs	75,317	13	Spices and drugs	37,564	4
Tobacco - -	1,676	24	Tobacco -	1,039	26
Corn - -	112,986		Corn - -	4,274	
Joiner's work -	158	33	Minerals - -	5,554	35
Earthen and glass ware - -	1,324	18	Joiner's work -	29,177	29
Mercury - -	112	56	Earthen and glass ware - -	11,410	8
Articles of dress	562	9	Printing materials	720	50
Wool, raw and manufactured -	250,906	12	Mercury - -	14,499	53
Cotton ditto -	120,033	36	Articles of dress	51,038	26
Thread - -	1,933	30	Woollen stuffs -	86,323	17
Silk and silk stuffs	4,327	12	Cotton, raw and manufactured -	18,396	41
Skins - -	134,628	22	Hemp ditto -	64,082	31
Other articles	835	34	Thread - -	37,432	
			Silk and silk stuffs	2,689	55
	1,537,683	1	Skins - -	7,441	5
	461,435	53	Other articles -	18,600	22
	1,076,247	8		461,435	53

Its trade with Vienna is altogether passive, and the merchants of that city draw considerable sums yearly from this province for gold and silver stuffs, silks, cloths, jewellery, &c. Its principal trade is with Wallachia, where it exports manufactured articles of wool, cotton, iron, glass, &c. and receives in return cattle, skins, wool, and cotton, and some Turkish merchandise.

Transylvania gives the title of grand prince to the king of Hungary, who holds the sovereignty of the province. The arms of the principality are those of the *three nations* united in one shield, and surmounted by the prince's crown. The Hungarians have an eagle; the Seklers the sun and moon; and the Saxons seven castles. These three classes have the exclusive privilege of forming states of the principality; and when any of the other nations, who are merely tolerated, obtain this privilege, they are received as members of the Saxon nation, or are raised by letters patent from the king, to the rank of Hungarian nobles. This privilege has been bestowed upon the two Armenian cities of *Szamosjuvar* and *Ibisfalva*, but the citizens in virtue of this prerogative are now classed among the naturalised Hungarians.

The Assembly of the States is composed of the governors of counties, the chief magistrates of the Saxons, and the royal judges of the Seklers; the deputies from the counties, districts, royal cities, and privileged towns; the council of the royal regency; the tribunal of justice, called the *Royal Table;* and all the magnats and nobles called to the Diet by letters-patent from the king. A royal commission presides, who opens and closes the Diet, and lays before it the royal propositions; but takes no share in its deliberations. All the political interests of the principality are discussed in this assembly, and even important affairs of a judicial nature; and to it belongs the power of making and repealing laws, with the consent of the prince; the levying of imposts; and the granting the privilege of naturalization to strangers upon the representation of the prince or a magnat. The government is administered by the *Royal Regency*, which holds its sittings at Klausenburg, and the administration of justice is conducted by the *Royal Table* sitting at Newmarket, which, for certain causes, is a tribunal in the first instance; and for others a court of appeal. There is, however, an appeal from its decisions to the Regency at Klausenburg, and from thence to the Aulic chancery of Transylvania at Vienna.

The revenues, amounting to nearly five millions of florins, arise from the *contribution* or imposts, yielding 1,300,000 florins, of which one-fifth is appropriated to the salaries of the officers of the province, and the remainder goes into the military chest; the customs; the tithe upon the working of the mines; the salt which belongs to the crown; the royal domains; the tithes paid by the counties; and the tithes levied upon the Saxons, and destined for the support of their own clergy.

The armed force of the principality consists of two regiments of infantry of the line; two regiments of Wallachians; and two of Seklers, which form the military cordon upon the frontiers of Turkey; one regiment of dragoons, and two of Hussars. The commander-in-chief resides at Hermanstadt.

The established forms of religion in Transylvania are, the Roman Catholic, the Reformed, the Lutheran, and the Socinian. The tolerated religions are the *Greek Schismatics* and the *Jews*. These different sects are divided, according to *Hassel*, into

Catholics, - - -	120,000
United Greek Church - -	160,000
Eastern Church, - -	916,500
Lutherans - - -	168,000
Other Protestants, - -	210,000
Socinians, - - -	44,000

Each of these sects has its own establishments for education. The Catholics have eight primary schools, seven academies of the higher branches, and a college at Klausenburg with nineteen professors. The Greek *Catholics*, in general, attend the Roman Catholic schools. They have, however, some primary schools of their own; and at Balusfalva they have a college, where the students receive gratuitous instruction, and also food. The Greek *Schismatics* prosecute their studies at the convent of Kronstadt, and have numerous schools under the inspection of a director, who trains young men for filling the office of schoolmaster. The Reformed have four superior colleges, which are well endowed, and six inferior. The Lutherans, besides a normal school for each village, have five colleges and eight burgh schools; but students who are destined for the profession of theology or medicine, are obliged to attend a foreign university. The Socinians have two colleges, and several schools. Notwithstanding, however, these numerous establishments, the state of literature in this province is very low. A literary society was instituted in 1793, whose labours were directed chiefly to the publication of rare works, of ancient history, with notes, and to the collection of materials for the history of their own country. It has also been employed in improving the Hungarian language, and in the general diffusion of science and literature. There are three libraries in this province deserving of attention; that of Baron Bruckenthal at Hermanstadt, to which is attached a valuable cabinet of gems and coins; and a gallery of paintings, perhaps the largest in the possession of any private individual in Europe; that of the late Count Ignatius Bauhyan, the Catholic bishop, which he bequeathed to the public, and which contains many rare editions and manuscripts; this prelate also built an observatory at Karlsburg, and endowed it along with the library with 38,000 florins; and that of Count Samuel Teleki at Newmarket, which is the most remarkable, and which, with a Museum of Natural History, has been open to the public since 1803.

Transylvania was originally inhabited by the *Getæ* or *Daci*, as they were called by the Romans, and with the rest of Dacia was reduced to a Roman province by Trajan. Having been successively subdued by the Sarmatians, Goths, and Huns, the Saxons, driven from their country by the conquests of Charlemagne, established themselves in this province, then known by the name of *Mediterranean Dacia*. Its principal towns and its cultivation owe their origin to this people, who bestowed upon it the name *Sibenburgen*, or the seven cities. Stephen, the first king of Hungary, annexed this province to his dominions in 1002, and governed it by viceroys, called *waywodes*. It continued subject to this power until 1527, when John Zapoli aspired to the throne of Hungary, in opposition to Ferdinand of Austria. The issue of this struggle was the conquest of Hungary by Sultan Soliman, and the conferring of Transylvania upon Stephen, the son of John Zapoli, to be held as a fief of the Ottoman throne. From this period Transylvania was regarded as a distinct state, and its princes entered into negotiations with the neigbouring potentates. About 1602, Sigismund the waywode formed an alliance with the house of Austria, and afterwards endeavoured to cede the principality to the empire; but the government of that power was odious to the inhabitants, who, under a succession of patriotic leaders, drove out the Austrian garrisons; and Bethlem Gabor, a noble Hungarian and a calvinist, extended his conquests over the greater part of Hungary. In 1657, Prince Ragotski excited, by his disobedience, a war with the Porte, which was terminated by his defeat and death; but the Transylvanians, enraged at the encroachments of the Ottomans, deposed their waywode, and having conferred the principality on *Kemeni*, one of Ragotski's generals, threw themselves under the protection of the Emperor Leopold, and admitted German garrisons into their principal fortresses. Kemeni, however, was soon after killed in a skirmish with the Turks, when Michael Abaffi, a vassal of the Porte, was elected waywode by the states. In the reverses which subsequently befel the Ottoman arms, Transylvania was relinquished to the emperor in 1698; since which time it has formed a part of the Austrian dominions. See Demian's *Tableau Geographique et Politique de Hongrie*, &c.

TRANSIT Instrument. See Astronomy, and Plate xlvii.

TRALEE, a post town on the west coast of Ireland, in the county of Kerry, situated near a small river which runs into Tralee bay. The jail and the court-house form one side of a square in the centre of the town. A castle, once the residence of the earls of Desmond, still remains, and traces of a monastery. The parish church is a plain building. Tralee returns one member to parliament. West Lon. 9° 35′. North Lat. 52° 16′.

TRANENT, a town of Scotland, in the county of East Lothian. It consists of a long street on the London road, with another going off from it to the north. The church, which is at the foot of the last of these streets, is a substantial building, with a square tower. A sum has been left to the town by Mr. Steel, to erect an hospital for the education of youth. Population about 1400.

TRANQUEBAR, a seaport town of India, situated at the mouth of the Caveri. When a village, it was purchased by the Danes in 1616, but it is now a very large town. It is defended by a neat fort, called Danebourg, remarkable for its whiteness. The town is about two miles in circuit, and surrounded with a wall with bastions. It contains three christian churches, one mosque, and several pagodas. The streets are broad and straight, and the houses neat. Population about 20,000. East Lon. 79° 55′. North Lat. 11° 1′. See Millburn's *Oriental Commerce*, vol. i. p. 267.

TRAVANCORE. See India, Vol. XII. p. 57.

TREBIZOND, the *Trapezus* of Xenophon, is a city of Asia Minor, situated on a gentle slope rising from the Black Sea. It is defended by two deep ravines, and by its ancient embattled ramparts, which are built of stone and very lofty. The houses, which are mean, are built of stone and lime, and roofed with tiles. It contains 18 large mosques, 8 khans, 5 baths, and 10 small Greek churches. The most remarkable building is the *Besestein*, a large square edifice with two small windows in each face, which is supposed to have been a Genevese powder magazine. The castle at the south end is a large building, commanding a full view of the city and environs. It is situated on a flat rock, and its ditches are cut out of the rock. Population about 15,000. East Lon. 39° 28′. North Lat. 41° 2′ 41″.

TRENTON, city of, the capital of New Jersey, situated on the left bank of the Delaware river, ¾ of a mile above the head of tide water, opposite the lower falls, and on the north side of the Assunpink creek, Hunterdon county, 30 miles from Philadelphia, and 50 from New York. North Lat. 40° 13′ 15″. West Lon. 0° 21′ 15″ of Philadelphia, and 2° 8′ 15″ of Washington, D. C. It is incorporated with city privileges, and governed by a mayor, recorder, 3 aldermen, and 13 assistants or common council. The state-house is 100 feet long, and 60 wide, in which the legislative sessions and superior courts are held; it is also used as a magazine for the state arms: there is also three fireproof offices, and a house for the residence of the governor, belonging to the state. Here is a bank, an academy, and a masonic hall. Trenton is identified with the history of the revolutionary war; the battle fought here, and the capture of the Hessians, gave the first favourable turn to the success of the American arms.

This city, with Mill-Hill, Bloomsbury, and Lamberton, on the opposite side of the creek, and extending 1¾ miles down the bank of the river, has 8 churches, viz. an episcopal, presbyterian, friends, baptist, reformed baptist, Roman catholic, methodist, and African methodist. The state-prison, at Lamberton, contains usually about 100 convicts; it is in contemplation to improve this, or erect a new one upon the modern plan. The bridge over the river, from Bloomsbury to Morrisville on the opposite side, is much admired for its architecture and elegance, for a particular description of which see article Trenton Bridge. The mills are 1 grist, and 5 for the manufacture of cotton fabrics, having 5400 spindles and 212 looms. A company is incorporated to create an additional water power, by means of a race-way, to be constructed in and along the bank of the river, equal to 700 horses, and considering its local advantages, will be equal to any in the United States. The Delaware and Raritan canal, now constructing, is located in the rear of these towns, which with the feeder, basin, aqueduct and locks, will add to the whole, beside the advantages, a more interesting scenery.

Trenton has, houses,		410,	inhabitants (1830)	2826
Mill-Hill,	"	78	"	486
Bloomsbury,	"	140	"	840
Lamberton,	"	64	"	306
Total,	"	692	"	4460

T. Gordon.

TRENTON Bridge, over the Delaware, about 30 miles above Philadelphia. See Plate DX. No. 2, Fig. 2. The first corner-stone of this bridge was laid on the 21st day of May 1804. The front of the abutment on the Pennsylvania side being 65 feet in advance from the bank, it was deemed prudent to make it thicker than the one on the opposite shore;

accordingly this abutment is 50 feet in front and 18 feet thick, with the back supported by a horizontal arch from its foundation.

The fronts of the abutments from the surface of the ground, and the ends, and about 40 feet of the wing walls above the banks, are carried up with cut stone in courses of range work, varying in depth as they proceed upwards from twenty to six inches, and *battering* half an inch in the foot: and although no ornament was sought for, this masonry exhibits a solidity of work, and neatness of execution, that reflects great credit on the workmen who constructed it. The cut stone in the abutments are all clamped together with iron clamps, as high as is presumed the ice or other floating substances will ever assail them; and in every tier of stone there are a number of branch clamps extending diagonally and crosswise the abutment, connecting the whole together. The interior is made up of large rough stone, many of half a ton weight and upwards, compactly filled in with smaller stone, and the whole laid in good lime and sand mortar, and forming one entire solid mass of masonry. These abutments are 19 feet above the ordinary flow of the tide, 6 feet above the highest freshes from ordinary causes, and at least 4 feet higher than the water has ever been known to rise, from obstructions by ice on the bars below. Besides this, the travelling way is raised nearly 3 feet higher; so that no injury can possibly be sustained in the wooden superstructure by any substances floating on, or carried down the river in the highest freshets.

The wing walls on the east side, at the distance of 60 feet from the front of the abutments, spread or splay 78 feet; and for the first 20 feet they run into the bank, are laid as deep as the foundation of the abutment, and 7 feet wide in the bottom. From the end of the angle, they are continued in a parallel line with each other, 103 feet farther, on a gradual taper to 4 feet, where they terminate. The exterior of this masonry is battered ½ an inch to the foot, while the interior is rather more than perpendicular; so that the filling has little or no pressure on the side walls, but will settle in perpendicular lines.

The wing walls on the west or Pennsylvania side, which are 85 feet in length from the front of the abutment, extend about 18 feet into the bank, and spread or splay 66 feet, being the width of the street leading to the bridge.

In laying the exterior courses of the foundations of the piers, great care was taken to select flat and long stones, running many feet into the body of the piers. On these, and throughout the whole interior, are laid large rough stone of vast weight, and the whole closely filled in with building stone. The depth of these foundations vary several feet in different parts of the piers, owing to the irregular surface of the rock, (in some places forming a pretty regular basin), and this is as an additional security against their being moved by ice, rafts, or other floating substances coming against them.

An offset of 6 inches is made on these foundations, where the cut stone commences: the pier here receives its proper shape and dimensions, which in this place is 68 feet in length, and 22 in breadth, with the end up stream, of a semicircular form. The levelling up of the foundation, and all the cut stone, are laid in terras mortar. On the pier next to the Pennsylvania shore, three courses of cut stone are laid, rising above the foundation to the height of 4 feet 7 inches. On each of the other piers one course only of cut stone is laid, of 20 and 22 inches in depth; in which situation ice and every other floating substance will run over them during the winter and spring seasons.

The span between the Pennsylvania abutment and the first pier, as well as between each of the other piers, is 194 feet; and from the New Jersey abutment to the first pier, the span is 156 feet, leaving a water way of 932 feet, out of 1100, the distance across the river from the top of one bank to the other.

The piers are all carried up with cut stone, in courses of range work, varying in depth as they proceed upwards, from 25 to 28 inches, until they rise to the top course, which is 12 inches, the sides and lower end battering ½ an inch in the foot; these stones extend into the body of the work, from 8 inches to 5 feet. The exterior or cut stone, as high as the water has ever been known to rise, is laid in terras mortar; and throughout the whole extent, lengthwise, every second or third course is clamped together with iron clamps. Crosswise also of the piers, every third or fourth course, eight or more iron cramps are extended from side to side, and let into the courses of cut stone. These, together with a vast number of branch cramps, it is presumed will effectually secure the whole from spreading or giving way in any direction. The ends of the piers, up stream, are semicircular, and after rising 4½ feet from their foundations, with the usual batter of the sides, they recede or batter at an angle of 67°, until they rise to the further height of 10 feet perpendicular, when they are again carried up with the former batter to the square, where they terminate, and receive their finish with a coping of cut stone, in the form of a half dome. The stones of which this angular part is composed, are all deep in their bed, extending from 2 to 5 feet into the pier, and are each secured with a clamp of iron. At this point the cut stone ceases, and the dimensions of the pier are here 62 feet in length, and 20 feet in breadth.

An offset of 8 inches is then made on the sides, and the square part of the piers again carried up, with a skew back, to the further height of 3 feet 9 inches. The feet of the arches rest on this offset and spring from this angle. The height of the piers next the shores, from the foot of the arches to ordinary low water mark, is 27 feet 5 inches, and of those in the middle, 28 feet 7 inches each. The distance between the abutments is 1008 feet, and the whole length of the bridge, including the wing walls, is one quarter of a mile.

The whole of the stone work done consists of 169,223 feet of cut stone, contained in 16,650 perches of masonry.

The superstructure consists of five arches, or five sets or series of arches, each composed of five sections or *ribs*, as they are usually called, and rising from the *chord* line, in the proportion of 13 feet in 100. These sections or ribs are formed of white pine plank, of from 35 to 50 feet in length, 4 inches thick, and 12 wide (except the middle section, which is 13), and repeated one over the other, breaking joints, until they form a depth of three feet through. This mode of constructing wooden arches is considered as a great improvement in bridge architecture, and we have reason to believe was first introduced into practice by Mr. Burr, the architect of this bridge. Be this as it may, it is supposed to possess many advantages over those formed of solid and massy pieces of timber. The relative situation of these sections is such as to leave two openings of 11 feet each, in the centre, for carriages, and two of 4 feet 6 inches each, on the sides, for foot walks. The general width of the bridge is therefore 36 feet from out to out, and the travelling ways will be on the chord line between these sections. Outside of the two exterior sections, wing arches of 50 feet in length, and of the same convexity and depth, are placed, which, inclining towards the centre, are united to these sections, and securely bolted through them. This gives the bridge an additional base of 16 feet, and a bearing of 52 *feet on each pier.* On the top or circumference of these sections and wing arches, beams or ties and diagonal braces are laid and let into each other, in the form of *lattice* work, and the whole firmly connected with the arches, by iron bolts with screws going through them at the distance of every eight feet: thus they are made to form one entire connected arch, which can neither admit of any sideway or intestine motion between the sections, nor be readily injured or endangered by high winds.

The platform on which the travelling is performed, is suspended from these arches, by means of iron chains or links, which hook into the eye-bolts, firmly fixed through the arches, at the distance, also, of every 8 feet in the three middle sections, and 16 feet in the two exterior ones. To the lower ends of these chains is appended a *stirrup*, in which the beams lay which sustain the joists and flooring. To prevent the platform from having any swinging motion, wing chords and diagonal braces are again interposed, which effectually perform this service.

The expansion of the arches (were not the solidity and weight of the piers and abutments of themselves sufficient) is completely guarded against by the intervention of wooden chords which embrace and connect the several feet of these arches together. These serve also a further important purpose, to wit, of stiffening and strengthening the arches, by means of upright bracing, which takes place between them and the chords; so that by the application of great weights, to either end of the arch, no vibratory motion can ensue, as the pressure is by this means distributed throughout the whole extent of the segment.

The three great objects, *convenience of travelling*, *strength*, and *durability*, are all happily united in the model adopted, nor has *ornament* been wholly thrown aside. The access to the bridge on either side, and throughout the whole extent of the platform, presents to the traveller a plane without any sensible rising.—The bridge was finished in the month of February 1806.—*Extracted from Mease's Wonders of Nature and Art.*

TREVES, the *Augusta Trevirorum* of the Romans, a town of Prussia, is situated in the centre of a large valley lying along the Moselle. It is about a mile and a half long, and has its streets tolerably wide. The chief buildings are the elector's palace, which now forms barracks. There are also here 5 parish churches and 13 monasteries and nunneries. Among these are the church of Notre Dame, that of St. Simeon, and the cathedral church of St. Peter's. The gymnasium occupies a building of great size, with a library in one of its wings. The piers of the bridge over the Moselle are very ancient. The corn market is regarded as a Roman work. Coins, medals, and inscriptions are frequently dug up here, and there are extensive remains of baths. Population 10,000. East Lon. 6° 38′ 20″. North Lat. 49° 46′ 37″.

TREVISO, a town of Austrian Italy, situated at the junction of the Piavesella and the Sile. The streets, though irregular, are broad and well paved, and the houses good, particularly the *palazzi*. The town contains the cathedral, 16 parish churches, 8 monasteries, 10 nunneries, 4 hospitals, a castle, and a theatre. It is surrounded with a rampart, and is three miles in circuit. The manufactures are silk and cotton stuffs and cutlery. Population 12,000, or 22,000 according to others. East Lon. 12° 9′. North Lat. 45° 42′.

TRIESTE, the *Tergeste* of the Romans, a sea-port town of Austria, and capital of a district in Illyria, is situated at the N.W. extremity of the Gulf of Venice. The old town stands on the side of a hill crowned with a castle which commands the whole of the city and the new town called Theresienstadt from its founder Maria Theresa, is situated on level ground intersected with a canal. There are several good streets in the town, and the houses are generally commodious. The principal public buildings are the cathedral, an ancient edifice, the former church of the Jesuits, the church of St. Anthony, the palace, the poor's and foundling's hospital, two Lazarettos, and a neat modern theatre. There is also here a gymnasium, a public library, a society of arts and sciences, and two insurance societies. The harbour is both secure and commodious, having three canals extending from it a good way into the town, so as to afford room for very large vessels. A magnificent mole, one of the finest objects in the town, was built by Maria Theresa when Austria was ambitious of making Trieste a place of importance. It extends about 1500 feet into the sea, and forms an excellent roadstead. There is room upon the mole for fifty pieces of cannon, though only thirty are mounted, some 18 and some 24 pounders. The mole includes the old Lazaretto, which is now employed solely as barracks. Opposite to the mole on the other side of the roadstead is the new Lazaretto, with a distinct harbour, which is likewise enclosed by a mole. The castle, situated on a height considerably above the town, must have been once strong, but it now serves only as a jail. It is surmounted by the imperial flag, and there are placed upon it a few pieces of cannon for firing salutes.

Shipbuilding is carried on to a considerable extent. The chief manufactures are soap made of oil, pottery, white lead, leather, paper, majolica, vitriol, silk, rossoli, (of which 600,000 bottles are annually exported,) wax-bleaching, sugar-refining; and the manufacture of anchors, cordage, and sail cloth are also carried on.

The exports from Trieste comprehend the produce of the mines of Idria and even Hungary, tobacco, lime, Austrian woollens, and Swiss cottons. The imports are cotton wool, silks, hides, raisins, rice, oil from the Levant, wheat from Odessa, and colonial produce from the Brazils and the West Indies. The wine called Reinfall, from the vineyards of Prosek, is much esteemed. There are extensive salt works at Zaule and Servola. Coal is obtained a few miles from the town. The annual fair begins on the 1st and ends on the 24th of August. The territory belonging to the town occupies 170 square miles, and contains a country population of nearly 9000.

About two leagues from the town is the interesting grotto of Corquale, so called from a village of that name. The road to it is over the summit of the mountain Paliso. The following account of it is given by Kuttner. "This grotto surpasses any that I ever beheld. The figures of the stalactites exhibit an uncommon variety of forms, and likewise a grander style and larger proportions than any I had ever yet met with. It is particularly distinguished for the columns on which the vaulted roof reposes, like that of a Gothic church. Many of these columns are 20, 30, or more feet in length, and of proportionable thickness. The flame of a torch, or of burning straw, produces a grand and picturesque effect. Many of the stalactites suspended from the roof are 12 or 15 feet in length, and at the top where they are united to it, are not less than 15 or 18 feet in circumference.

"The grotto has the peculiarity that the entrance is not horizontal into a hill or eminence, but in a plain from which you are obliged to descend nearly in a perpendicular direction. You continue descending steep declivities, arriving now and then at nearly perpendicular shafts, in which a kind of stone steps have been cut; but they have been formed with so little care, and are partly rendered so slippery with water that is constantly dropping upon them, that you every moment run great risk of falling. We proceeded about a quarter of an hour when the steps ceased, and the perpendicular descent prevented our advancing any farther. I am informed that the length of this grotto has never been ascertained, but that, from various reasons, it is supposed to have a second opening at the distance of two German, upwards of nine English miles."

At the end of 1824, the population of Trieste and its territory, comprising the garrisons and strangers, was 43,693 inhabitants. In 1826, it was as follows:

Births	Males	981	1,976	Difference 544.
	Females	995		
Deaths	Males	776	1,435	
	Females	659		

Total population on 1st January 1826,	44,234
Marriages in 1825, - - -	410

Repartition of this Population.

City of Trieste, - - -			27,325
Territory, - - - -			7,909
Garrison,	on land,	2,000	8,000
	at sea,	6,000	
Strangers, - - - -			1,000
			44,234

East Lon. 13° 47′ 8″. North Lat. 45° 38′ 8″.

See Lascasas's *Travels in Istria and Dalmatia*, and Kuttner's *Travels in Germany, &c.* vol. iv.

That part of Trieste along and adjacent to the harbour is liable to very destructive inundations from the wind tides, the only tides indeed that occur to any serious amount in the Gulf of Venice. The casual swell is, however, great, sudden, and ruinous. Such a catastrophe occurred on the 8th of October 1829, when the waves reached the under stories of all the lower part of the city, and produced destructive consequences in cellars, storehouses, warehouses and magazines. The loss was immense.

TRIGG, county of Kentucky, bounded by Caldwell N.W., Christian E., Montgomery county of Tennessee S.E., Stewart county of Tennessee S.W., and Tennessee river separating it from Calloway county, Kentucky, W. Length along the eastern boundary 34, mean breadth 12, and area 408 square miles. Extending in Lat. from 36° 38′ to 37° 05′ N., and in Lon. from 10° 42′ to 11° 12′ W. from W. C.

Cumberland river enters the southern boundary from the state of Tennessee, and flowing in a direction a little W. of N. divides Trigg into two unequal portions. The smaller section, a parallelogram between Tennessee and Cumberland rivers, contains about 80 square miles. The body of the county lies east of Cumberland river, and, with a westerly declivity, is drained by different branches of Little river, a small stream rising generally in Christian and Todd counties.

By the post office list of 1830, there were four post offices in this county, at Cadiz, the seat of justice, at Canton, Cerulean Springs, and at Lindsay's Mills.

Cadiz, the seat of justice, stands on Little river, near the centre of the county, about ninety miles N.W. by W. from Nashville in Tennessee, seventy-five S.E. by S. from Shawneetown, Gallatin county, Illinois, and by post road 226 miles S.W. by W. from W. C. N. Lat. 36° 45′, and in Lon. 10° 48′ W. from W. C. Population of the county in 1820, 3874. See Synopsis, article UNITED STATES.

TRIGONOMETRY.

Trigonometry, (Τριγωνομετρια from Τριγωνος *a triangle*, and μετρεω *I measure*) in its original sense signified that part of mathematical science which treated of the admeasurement of triangles. Triangles were supposed to be either described upon *a plane* or upon the surface of *a sphere*, and hence the science was divided into *plane trigonometry* and *spherical trigonometry*.

Like every other department of science, the objects of trigonometry became more extended as knowledge advanced and discovery accumulated, and this department of mathematical science, which was at first confined to the solution of one general problem, viz. "given certain sides and angles of a triangle to determine the others," has now spread its uses over the whole of the immense domains of mathematical and physical science. In the wide range of modern analysis, there is scarcely a subject of investigation to which trigonometry has not imparted clearness and perspicuity by the use of its language and its principles; and the physical investigations of philosophers of our times are still more largely indebted for their conciseness, elegance, and generality, to the symbols and established formulæ of this science.

In its present improved and enlarged state, trigonometry might not improperly be called the *angular calculus;* for however extensive and various its more remote uses and applications may be, its immediate object is to institute a system of symbols, and to establish principles by which angular magnitude may be submitted to computation, and numerically connected with other species of magnitude; so that angles and the quantities on which they depend, or which depend on them, may be united in the same analytical formulæ, and may have their mutual relations investigated by the same methods of computation that are applied to all other quantities.

It is not easy nor indeed possible to trace back trigonometry to its earliest origin. Most probably this science took its rise in the solution of some problems relative to heights or distances, so inaccessible as not to admit of direct measurement. In the rudest state of geometrical knowledge the similitude of equiangular triangles must have been known. This indeed is a property so obvious and striking, that the practical conviction of its truth must have long preceded its geometrical demonstration. This then being understood, it was an easy step to perceive that a small and measurable triangle might be constructed similar to a large and immeasurable one, so that the sides of the large one might consist of as many leagues as those of the small one of inches. Thus if the number of leagues in any one side of the large one be measured, and a line be drawn consisting of as many inches, a triangle constructed upon that line having the same angles as the large triangle, will have its other sides consisting of as many inches as there are leagues in the other sides of the large one. Such is in fact the foundation of the application of trigonometry to the measurement of triangles.

In the first instance, trigonometry must have been considered not as a separate part of science, but simply as a class of geometrical problems. As however their number increased and their useful application became extended, they gradually assumed the form of a distinct science. The earliest work on this subject of which we have any record, is one by Hipparchus, who flourished about 150 years before the Christian era. Theon informs us that Hipparchus wrote a work *on the Chords of Circular Arcs,* a title from which we collect that the subject must have been trigonometry, or the doctrine of *sines.*

The earliest work extant on the subject is the spherics of Theodosius. In the first century Menelaus is said to have written nine books on trigonometry, of which, however, only three have come down. The earliest trigonometrical tables which we have received are those of Ptolemy, given in his Almagest. In these he adopts the sexagesimal division of the arc, whose chord is equal to the radius, and reckons all arcs by sixtieths of that arc, and all chords by sixtieths of the radius. In the eighth century sines or half-chords were introduced by the Arabians, which was the only striking improvement which the science received until the 15th century, when Purbach abandoned the sexagesimal division of the radius and constructed a table of sines to a radius of 600,000, computed for every ten minutes of the quadrant. Subsequently Regiomontanus adopted a radius of 1,000,000, and calculated sines for every minute.

In the sixteenth century several mathematicians contributed to the advancement of the science, particularly by improvements in the form of tables. By far the most conspicuous among these was the celebrated Vieta. This mathematician, in a work entitled "Canon Mathematicus seu ad triangula cum appendicibus," gave a table of sines, tangents, and secants for every minute of the quadrant to the radius of 100,000, with their differences. At the end of the quadrant the tangents and secants are extended to eight or nine places of figures. The second part of this work contains an account of the construction of tables, plane and spherical trigonometry, miscellaneous problems, &c.

The necessity of having accurate tables for all computations in physical and mathematical science, directed the attention of mathematicians at this period to this department of trigonometry in particular. Accordingly we find many elaborate computations, among which may be mentioned the work of Rheticus, published subsequently by Otho his pupil, and afterwards corrected by Pitiscus.

This work contains a trigonometrical canon for every ten seconds of the quadrant to fifteen places of figures. The sines and cosines were computed for every second in the first and last degrees of the quadrant.

With all the assistance derivable from tables, the labour of trigonometrical computation was still excessive, and consequently the chances of error proportionally great. Stimulated by the desire to remove or overcome this difficulty, the celebrated Napier applied the energies of a powerful mind to the subject, and the result was the invention of logarithms. For the particulars of this admirable invention and its history, the reader is referred to our article LOGARITHMS.

To Napier we are also indebted for those technical methods of retaining a large class of formula, which are necessary for the solution of spherical triangles, and which are known by the name of *Napier's rules* and *Napier's analogies*. In the course of the following treatise, we shall have occasion to explain these.

Towards the end of the last century, trigonometry underwent a complete revolution, by being altogether transformed from a geometrical science, as it had heretofore been uniformly treated, into an analytical one. This change took its rise in that department of trigonometry called the theory of angular sections, and which was first successfully cultivated by Vieta. The object of this part of the science is to express the sines, cosines, tangents, &c. of any proposed multiples or submultiples of an arc, as functions of the arc itself, or of its sine, cosine, tangent, &c. This class of problems from its nature not admitting of geometrical investigation, the powers of analysis were necessarily resorted to, and its language and principles once admitted within the pale of trigonometry, spread their influence through the whole science, so that at length they reached its most elementary parts, and have now left nothing geometrical except the definitions, if indeed we can admit the necessity of giving even these a geometrical form.

To this happy subversion of the geometrical method and the substitution of the analytical, is due all that power and facility of investigation which the analyst receives from the formulæ of this science. To this is due the great generality of its theorems, the beautiful symmetry which reigns among the groups of results, the order with which they are developed one from another, offering themselves as unavoidable consequences of the method, and almost independent of the will or the skill of the author. The singular fitness with which the language of analysis adapts itself so as to represent, even to the eye, all this order and harmony, are effects too conspicuous not to be immediately perceived. Nor is the elegant form which the science has thus received from the hand of analysis, a mere object pleasurable to contemplate but barren of utility. All this order and symmetry, which is given as well to the matter as to the form, as well to the things expressed as to the characters which express them, not only serves to impress the knowledge indelibly on the memory, but is the fruitful source of further improvement and discovery.

The advantages which have resulted from the conversion of trigonometry into an analytical science have not been, however, confined to trigonometry itself. Almost every part of physical science has felt the benefit of this change, and none in a greater degree than astronomy. Many of the most brilliant discoveries, with which modern times have enriched this science, could scarcely be expressed, much less discovered, without the aid of the language of analytical trigonometry.

One of the last improvements which trigonometry has received from analysis, is in the theory of angular sections before mentioned. Notwithstanding the attention which has been devoted to this subject by some of the most profound analysts from the time of Euler to the present day, it remained until a very late period in an imperfect state. Formulæ, expressing relations between the sine and cosine of an arc, and those of its multiples, were established by Euler, and subsequently confirmed by the searching analysis of Lagrange, which have since been proved inaccurate, or true only under particular conditions; and it was not until within a few years that the complete exposition of this theory was published, and general formula assigned, expressing those relations. In the year 1811, M. Poissin detected an error in a formula of Euler, expressing the relation between the power of the sine or cosines of an arc, and the sines and cosines of certain multiples of the same arc. But the most complete discussion of the subject, which has hitherto appeared in a separate form, is contained in a memoir read before the academy of sciences at Paris, by Poinsot, an eminent French mathematician, in the year 1823, and further developed by him in another memoir, published in the year 1825. The reader will also find some interesting discussions on this subject in the *Bulletin Universel*, scattered in various parts of that work for the last three years.

Works on trigonometry have been so numerous that it would be vain to attempt an enumeration of them here. The English elementary treatises have been, with two exceptions, uniformly geometrical. The first treatise in which the subject was presented in an analytical form was that of the late Professor Woodhouse of Cambridge. At a more recent period, a much more detailed treatise has been published by Dr. Lardner. This treatise is perhaps more exclusively analytical than any which has yet appeared. Dr. Lardner has borrowed from geometry no other principle except the proportionality of the sides of equiangular triangles. In this treatise we find a very complete analysis of angular sections, including all the recent corrections and improvements. The following treatise is abridged from this work by the consent of the author.

PLANE TRIGONOMETRY.

SECTION I.

Of Angles and Arcs.

(2.) The angular space which surrounds a point may be divided into four right angles by two straight lines, in directions perpendicular to each other, and passing through the point. If lines be supposed to be drawn through the point of intersection of these two lines, dividing each of the four right angles into ninety equal angles, each of these angles is called a *degree*, and, therefore, the entire angular space around the point consists of four times ninety, or 360 degrees.

If each of these angles, called *degrees*, be divided into 60 equal angles, each of these smaller subdivisions is called *a minute*.

In like manner, each *minute* being subdivided into sixty equal angles, these subdivisions are called *seconds*.

A second is the smallest angle which has received a distinct denomination. All smaller angles are usually expressed as decimal parts of a second.

Degrees are expressed by 0 placed over their number.

Thus, forty-five degrees, or half a right angle, is expressed 45°; thirty degrees, or a third of a right angle, thus, 30°.

Minutes are expressed by an accent ′ placed over their number, thus, 5′ signifies five minutes; and seconds by a double accent ″, thus, 5″ signifies five seconds.

Thus,

$$35^\circ \quad 17' \quad 10''5$$

signifies thirty-five degrees + 17 minutes + 10 seconds + 5 tenths of a second.

(3.) In some foreign mathematical and physical works a different division of angles is used, with which it is necessary the student should be acquainted. It has been long considered that the division of the right angle into ninety equal parts was unnatural and inconvenient, and several mathematicians, both British and continental, have from time to time proposed a decimal division. This has been actually carried into effect in France, and adopted by many writers of that country. They divide the angular space round a point into four hundred equal parts, which they call degrees.

Each degree is divided into a hundred minutes, and each minute into a hundred seconds, and so on.

Thus it is equally easy to express an angle in degrees and decimal parts of a degree, as in degrees, minutes, and seconds.

$$36^\circ.567329 = 36^\circ \; 56' \; 73'' \; 29'''.$$

The mark ‴ denoting hundredth parts of a second.

The degree may here, therefore, be taken as the angular unit.

The former division is called the *sexagesimal*, and the latter the *decimal* division.

(4.) It is an established principle of geometry, that the circumferences of different circles are proportional to their radii; and hence we infer that similar arcs of circles are also proportional to their radii, and *vice versa*. Two arcs of different circles, therefore, which bear the same ratio to their respective radii must be similar, and therefore consist of the same number of degrees, minutes, and seconds.

From these principles it follows that an arc of one second of all circles is contained the same number of times in their radii, and from the calculation of the ratio of the circumference of a circle to its diameter, it is known that this number differs from 206265 by a small fraction. Therefore the radius of any circle differs from an arc of 206265 seconds by a small fractional part of a second. The circumference of a circle being incommensurable with its diameter, it is impossible to express the exact length of the radius in seconds and parts of a second.

(5.) Angles in plane geometry being in general those of triangles, are generally considered as not exceeding 180°. We shall, however, take a more general view of angular magnitude, and consider it like every other species of quantity as capable of unlimited increase as well as unlimited diminution. If a line be supposed to revolve round a given point, and in a given plane, it will, in one revolution, move through an angle of 360°; in one revolution and a quarter through 360°+90°. Or if 180° be called π, the revolving radius in every revolution will move through the angle 2π and in every quarter of a revolution through $\frac{\pi}{2}$, and in every half revolution through π. In general if n be an integer. The radius, after a number of complete revolutions, will have moved through an angle expressed by $2n\pi$. If it has exceeded a complete number of revolutions by an angle α, the angle which it has described, will be expressed by $2n\pi+\alpha$, and if it fall short of a complete number, it will be expressed by $2n\pi-\alpha$. If the angle it has described exceed an exact number of revolutions by half a revolution, we shall get its expression by changing α into π in the former formula, which gives $2n\pi + \pi = (2n+1)\pi$.

In like manner, if the angle, which the revolving radius has moved through, exceed or fall short of a complete number of revolutions by a right angle, its expression will be found by changing α into $\frac{\pi}{2}$ in each of the formulæ, which gives,

$$2n\pi + \frac{\pi}{2} = (2n + \tfrac{1}{2})\pi \text{ and } 2n\pi - \frac{\pi}{2} = (2n - \tfrac{1}{2})\pi$$

The angle $\frac{\pi}{2} - \alpha$ is called the *complement* of α, and the angle $\pi - \alpha$ is called the *supplement* of α.

SECTION II.

Of Trigonometrical Terms and their Mutual Relations.

(6.) It is an established property of a right angled triangle, that if the ratio of any pair of its sides be known, the angles and the ratios of the other sides may be found. This forms the fundamental principle of trigonometry, the exponents of these ratios being here adopted as the criterions for the determination of the angles.

As there are three pairs of sides in a right angled triangle differently related to either of its acute angles, so there are three ratios which will determine the angle.

Let ω be the angle, y the opposite side, and x the containing side, and r the hypothenuse; the angle ω may be indifferently determined by any of the three numbers.

$$\frac{y}{r},\quad \frac{y}{x},\quad \frac{r}{x},$$

The first $\frac{y}{r}$ is called the *sine* of the angle ω, the second $\frac{y}{x}$ is called its *tangent*, and the third $\frac{r}{x}$ is called its *secant*. The origin of these denominations we shall presently explain.

The three ratios which are the reciprocals of those already expressed, scil.

$$\frac{x}{r},\quad \frac{x}{y},\quad \frac{r}{y}.$$

bear the same relation to the other acute angle of the triangle as the former do to the assumed one. One acute angle being the *complement* (5.) of the other, it follows that $\frac{x}{r}$, $\frac{x}{y}$, and $\frac{r}{y}$, are the sine, tangent, and secant of the complement of the proposed angle, and are thence called its *co*-sine, *co*-tangent, and *co*-secant.

(7.) We shall now explain the origin of these denominations.

With the centre C, and the linear unit CA as radius, let a circle be described, and let another radius CA″ be drawn, making any angle ω with the initial radius CA. From A″ draw the perpendicular A″P to the initial radius CA, and from A draw the tangent, and produce CA″ to meet it at T. Now, if y, x, and r, be the three sides of a right angled triangle similar to A″PC, ω being the angle opposite to y, we have

$$\frac{y}{r}=\frac{\text{A}''\text{P}}{\text{CA}}=\sin.\ \omega.$$

But since CA is assumed as the linear unit, $\therefore$ A″P$=\sin.\ \omega$.

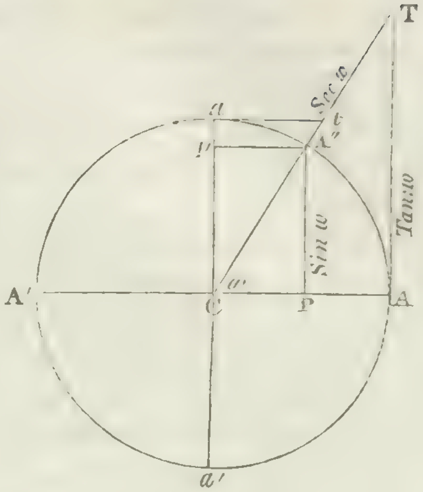
Again, since TCA is also similar to the same triangle, we have

$$\frac{y}{x}=\frac{\text{TA}}{\text{CA}}=\tan.\omega.$$

$$\therefore \text{TA}=\tan.\omega.$$

$$\frac{r}{x}=\frac{\text{CT}}{\text{CA}}=\sec.\omega.$$

$$\text{CT}=\sec.\omega.$$



(8.) From the definitions of the trigonometrical terms which we have just given, their mutual relations become manifest. As these relations are in effect the fundamental principles of trigonometry, we shall here give them in some detail.

By the definitions we have,

$$\sin.\omega=\frac{y}{r}[1],\ \tan.\omega=\frac{y}{x}[2],\quad \sec.\omega=\frac{r}{x}[3],$$

$$\cos.\omega=\frac{x}{r}[4],\ \cot.\omega=\frac{x}{y}[5],\ \text{cosec}.\omega=\frac{r}{y}[6].$$

(9.) By squaring [1] and [4], and adding the results, we have

$$\sin.^2\omega+\cos.^2\omega=1,$$

since $r^2=x^2+y^2$.

(10.) By dividing [1] by [4], we have

$$\frac{\sin.\omega}{\cos.\omega}=\frac{y}{x},\therefore\frac{\sin.\omega}{\cos.\omega}=\tan.\omega.$$

(11.) By multiplying [2] and [5], we obtain

$$\tan.\omega\ \cot.\omega=1.$$

Thus the tangent and cotangent are reciprocals.

(12.) In like manner, by multiplying [3] and [4], we have

$$\sec.\omega\ \cos.\omega=1.$$

The secant and cosine are therefore reciprocals.

(13.) It follows also by multiplying [1] and [6], that

$$\text{cosec}.\omega\ \sin.\omega=1,$$

therefore the cosecant and sine are reciprocals.

(14.) By squaring [2], and adding unity to the result, we find

$$\tan.^2\omega+1=\frac{y^2+x^2}{x^2}=\frac{r^2}{x^2},$$

$$\therefore \sec.^2\omega=1+\tan.^2\omega.$$

(15.) In like manner, by squaring [5] and adding unity, we obtain

$$\text{cosec}.^2\omega=1+\cot.^2\omega.$$

(16.) By [9.] and [10.] it follows that

$$\frac{\cos.\omega}{\sin.\omega}=\text{co}\ \omega$$

(17.) Trigonometrical, like all other algebraical quantities, are susceptible of different signs under different circumstances. The signs of the sine and cosine are determined by the same rules as the coordinates of a point in analytic geometry. To explain the several changes of sign of the sine and cosine, let C be the centre of a circle whose radius CA is unity, and let CA be the initial position of the revolving radius.

When the radius coincides with CA, the sine of the arc = 0, and the cosine = 1. This will be manifest from considering the triangle CPM to be continually changed by the radius CP approaching CA. During this change PM, the sine of the angle continually diminishes, and CM its cosine continually approaches to equality with CA or unity; and when the angle at C actually vanishes, and CP coincides with CA, then PM vanishes, and CM becomes equal to CA.

Hence for all angles terminated by the radius CA, the sine = 0, and the cosine = 1.

While the revolving radius moves from CA through the angle AC*a*, the sine PM continually increases, and the cosine decreases until it coincides with C*a*, where the sine coincides with C*a*, and is ∵ = 1, and the cosine vanishes, or = 0.

Through the angle AC*a* we shall consider the sine and cosine, both positive, and, in general, we shall consider those sines which are measured from the diameter AA′ in the direction C*a* as positive, and those which are measured in the opposite direction C*a*′ as negative.

Also, those cosines which are measured in the direction CA we shall consider positive, and those in the opposite direction CA′ negative. It will be found that by this arrangement all trigonometrical quantities will change their signs upon passing through zero and infinity. As the radius revolves through the angle *a*CA′ from C*a* towards BA′, the sine diminishes, but is still positive, and the cosine increases, and is negative. Thus, at C*a* the cosine passes through zero, and changes its sign. When the radius coincides with CA′, the sine = 0, and the cosine coinciding with CA′ is = — 1.

Through the angle A′C*a*′ the sine increases, and the cosine diminishes, both being negative, the sine changing its sign in passing through 0 at CA′; and at C*a*′ the cosine vanishes, and the sine coincides with C*a*′, and ∵ = — 1.

Also, those cosines which are measured in the direction CA we shall consider positive, and those in the opposite direction CA′ negative. It will be found that by this arrangement, all trigonometrical quantities will change their signs upon passing through zero and infinity. As the radius revolves through the angle *a*CA′ from C*a* towards CA, the sine diminishes, but is still positive, and the cosine increases, and is negative. Thus, at C*a* the cosine passes through zero, and changes its sign. When the radius coincides with CA′ the sine = 0, and the cosine coinciding with CA′ is = — 1.

Through the angle A′C*a*′ the sine increases, and the cosine diminishes, both being negative, the sine changing its sign in passing through 0 at CA′; and at C*a*′ the cosine vanishes, and the sine coincides with C*a*′, and ∴ = — 1.

Through *a*′CA the sine diminishes continuing negative, and the cosine increases and is positive, thus changing its sign in passing through zero at C*a*′.

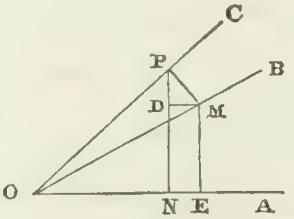
Thus the several changes which the sine and cosine undergo in one revolution of the radius are evident, and they suffer the same changes every revolution.

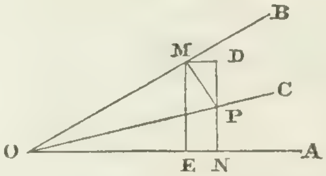
By the formulæ found in (10) and (16), it follows that the tangent and cotangent are positive when the sine and cosine have like signs, and negative when they have unlike signs; and by (12) it appears that the sign of the secant is always that of the cosine; and by (13) that the sine of the cosecant is always that of the sine. Thus the signs of the sine and cosine regulate those of all other trigonometrical terms.

SECTION III.

Of the Relations between Angles and their Sums and Differences.

(18.) *Given the sines and cosines of two arcs to find the sines and cosines of their sum and difference.*





Let AOB be the greater angle, α and BOC the less α'. Then AOC will be the sum $\alpha+\alpha'$ or the difference $\alpha-\alpha$ according as OC and OA lie at different sides of OB or at the same side. Take any point P on OC and draw PM and PN perpendicular to OB and OA, and from M draw ME perpendicular to OA. Through M draw MD parallel to OA to meet NP produced if necessary at D. By the definition we have

$$\sin.\alpha=\frac{ME}{MO},\quad \sin.\alpha'=\frac{PM}{PO},\quad \sin.(\alpha\pm\alpha')=\frac{PN}{PO}.$$

$$\cos.\alpha=\frac{EO}{MO},\quad \cos.\alpha'=\frac{MO}{PO},\quad \cos.(\alpha\pm\alpha')=\frac{NO}{PO}.$$

But PN = DN ± DP. Hence,

$$\sin.(\alpha\pm\alpha')=\frac{DN}{PO}\pm\frac{DP}{PO}=\frac{ME}{PO}\pm\frac{DP}{PO}$$
$$=\frac{ME}{MO}\cdot\frac{MO}{PO}\pm\frac{DP}{PM}\cdot\frac{PM}{PO}$$

By the similar triangles, $\frac{DP}{PM}=\frac{EO}{MO}$. Hence,

$$\sin.(\alpha\pm\alpha')=\sin.\alpha\cos.\alpha'\pm\sin.\alpha'\cos.\alpha. \qquad [1.]$$

In like manner NO = OE ∓ NE = OE ∓ DM.

Hence, $\cos.(\alpha\pm\alpha')=\frac{OE}{PO}\mp\frac{DM}{PO}$.

$$=\frac{\mathrm{OE}}{\mathrm{OM}}.\ \frac{\mathrm{OM}}{\mathrm{PO}}\mp\frac{\mathrm{DM}}{\mathrm{PM}}.\ \frac{\mathrm{PM}}{\mathrm{PO}}.$$

By similar triangles, $\frac{\mathrm{DM}}{\mathrm{PM}}=\frac{\mathrm{ME}}{\mathrm{MO}}$ Hence,

$\cos.(\omega\pm\omega')=\cos.\omega\cos.\omega'\mp\sin.\omega\sin.\omega'.$ [2].

Throughout this investigation, the upper sign refers to the first figure, and the lower to the second.

(19.) From the formulæ [1] may be deduced a group of four others by merely adding, subtracting, multiplying, and dividing them.

1°. By adding them we obtain

$\sin.(\omega+\omega')+\sin.(\omega-\omega')=2\sin.\omega\cos.\omega'$ [3].

2°. By subtracting,

$\sin.(\omega+\omega')-\sin.(\omega-\omega')=2\sin.\omega'\cos.\omega$ [4].

3°. By multiplying,

$\sin.(\omega+\omega')\sin.(\omega-\omega')=\sin.^2\omega\cos.^2\omega'-\sin.^2-\cos.^2\omega'$

Eliminating $\cos.^2\omega'$ and $\cos.^2\omega$ the result is,

$\sin.(\omega+\omega')\sin.(\omega-\omega')=\sin.^2\omega-\sin^2\omega'$ [5].

4°. By dividing,

$$\frac{\sin.(\omega+\omega')}{\sin.(\omega-\omega')}=\frac{\sin.\omega\cos.\omega'+\sin.\omega'\cos.\omega}{\sin.\omega\cos.\omega'-\sin.\omega'\cos.\omega}.$$

Eliminating the sines and cosines of ω and ω' the result is,

$$\frac{\sin.(\omega+\omega')}{\sin.(\omega-\omega')}=\frac{\tan.\omega+\tan.\omega'}{\tan.\omega-\tan.\omega'}\qquad[6].$$

(20.) In a similar way the following group of four formulæ may be deduced from [2] by addition, subtraction, multiplication, and division.

$\cos.(\omega+\omega')+\cos.(\omega-\omega')=2\cos.\omega\cos.\omega'$ [8].

$\cos.(\omega+\omega')-\cos.(\omega-\omega')=-2\sin.\omega\sin.\omega'$ [9].

$\cos.(\omega+\omega')\cos.(\omega-\omega')=\cos.^2\omega+\cos.^2\omega'-1$ [10].

$$\frac{\cos.(\omega+\omega')}{\cos.(\omega-\omega')}=\frac{\tan.\omega'-\tan.\omega}{\tan.\omega'+\tan.\omega}\qquad[11].$$

(21.) *Given the tangent of two angles, to determine the tangents of their sum and difference.*

By dividing [1] by [2], we obtain,

$$\frac{\sin.(\omega\pm\omega')}{\cos.(\omega\pm\omega')}=\frac{\sin.\omega\cos.\omega'\pm\sin.\omega'\cos.\omega}{\cos.\omega\cos\omega'\mp\sin.\omega\sin.\omega'}.$$

Eliminating the sines and cosines by the values for the tangents in (10), we find

$$\tan.(\omega\pm\omega')=\frac{\tan.\omega\pm\tan.\omega'}{1\mp\tan.\omega\tan.\omega'},\qquad[13].$$

(22.) From the formulæ [3], [4], [8], [9], we can derive the following group, by considering $(\omega+\omega')$ and $(\omega-\omega')$ as single angles, and ω and ω' as their half sum and half difference, expressing the former by ω and ω', and consequently the latter by $\frac{1}{2}(\omega+\omega')$ and $\frac{1}{2}(\omega-\omega')$.

$\sin.\omega+\sin.\omega'=2\sin.\frac{1}{2}(\omega+\omega')\cos.\frac{1}{2}(\omega-\omega')$ [14].

$\sin.\omega-\sin.\omega'=2\sin.\frac{1}{2}(\omega-\omega')\cos.\frac{1}{2}(\omega+\omega')$ [15].

$\cos.\omega+\cos.\omega'=2\cos.\frac{1}{2}(\omega+\omega')\cos.\frac{1}{2}(\omega-\omega')$ [16].

$\cos.\omega-\cos.\omega'=-2\sin.\frac{1}{2}(\omega+\omega')\sin.\frac{1}{2}(\omega-\omega')$ [17].

(23.) From these four a group of six others may be immediately deduced by division. Let the first be divided successively by the second, third and fourth; the second by the third and fourth; and the third by the fourth. After this division, the sines and cosines of $\frac{1}{2}(\omega+\omega')$ and $\frac{1}{2}(\omega-\omega')$ being eliminated by the formulæ found in (10) and (16), we obtain the following formulæ:

$$\frac{\sin.\omega+\sin.\omega'}{\sin.\omega-\sin.\omega'}=\frac{\tan.\frac{1}{2}(\omega+\omega')}{\tan.\frac{1}{2}(\omega-\omega')}\quad.\qquad[18].$$

$$\frac{\sin.\omega+\sin.\omega'}{\cos.\omega+\cos.\omega'}=\tan.\tfrac{1}{2}(\omega+\omega')\quad.\qquad[19].$$

$$\frac{\sin.\omega+\sin.\omega'}{\cos.\omega-\cos.\omega'}=-\cot.\tfrac{1}{2}(\omega-\omega')\quad.\qquad[20].$$

$$\frac{\sin.\omega-\sin.\omega'}{\cos.\omega+\cos.\omega'}=\tan.\tfrac{1}{2})\omega-\omega')\quad.\qquad[21].$$

$$\frac{\sin.\omega-\sin.\omega'}{\cos.\omega-\cos.\omega'}=-\cot.\tfrac{1}{2}(\omega+\omega')\quad.\qquad[22].$$

$$\frac{\cos.\omega+\cos.\omega'}{\cos.\omega-\cos.\omega'}=-\cot.\tfrac{1}{2}(\omega+\omega')\cot.\tfrac{1}{2}(\omega-\omega')\ [23].$$

(24.) The sine and cosines of the doublet of an angle may be found by making $\omega=\omega'$ in [1] and [2]. This gives,

$\sin.2\omega=2\sin.\omega\cos.\omega\quad\cos.2\omega=\cos.^2\omega-\sin.^2\omega=2\cos.^2\omega-1.$

(25.) If in the last formulæ 2ω be changed into π and therefore ω into $\frac{1}{2}\omega$ we find the values for the sine and cosine of half an angle.

$$\sin.^2\tfrac{1}{2}\omega=\tfrac{1}{2}(1-\cos.\omega)\qquad\cos.^2\tfrac{1}{2}\omega=(1+\cos.\omega).$$

(26.) The tangent of half an angle may be derived from these by (10) and (16), and hence we find,

$$\tan.\omega\tfrac{1}{2}=\frac{\sin\omega}{1+\cos.\omega}=\frac{1-\cos.\omega}{\sin.\omega}=\sqrt{\frac{1-\cos.\omega}{1+\cos.\omega}}.$$

SECTION IV.

On the Solution of Plane Triangles.

(27.) In a plane triangle there are six parts, the three sides and the three angles. In general, if the magnitudes of any three of these six quantities be given, the magnitudes of the other three may be computed by the aid of the formulæ and tables of trigonometry.

To guide us in some degree in the determination of formulæ exhibiting the relations of the parts of a triangle, it is necessary that we should attend to the nature of the tables, by the aid of which these formulæ are to be computed when particular numbers are substituted for their general symbols. These tables are in general logarithmic, and by them, whenever an angle is known, the logarithms of its sine, cosine, tangent, &c. can be determined, and, *vice versa*, when any of the latter are *known*, the angle can be found. Formulæ, therefore, in order to be suited to such tables, should be such as are adapted for logarithmic calculation, and therefore their different parts should be united as much as possible by multiplication, division, involution, and evolution; and as little as possible by addition and subtraction.

Further, as it would be impossible in any tables to give the values of the sine, cosine, &c. of angles of all magnitudes, it must frequently happen that the angle, sine, or cosine, &c. which we seek, lies between two successive tabulated angles, sines, or cosines, &c. We can in this case only compute the true value approximately, and the degree of the approximation frequently depends on the formula which we use. A formula which is proper when the angle is great, is often ill suited if the angle to be computed be small. Hence it is necessary in some cases to establish several different formulæ for the solution of the same problem, some being fitted for calculation in the cases where others fail, or give results deviating considerably from the truth.

The Solution of Right-angled Triangles.

(28.) Of the six parts of a triangle, it is only necessary to consider four in the case of a right-angled triangle; since the right angle is always given, and one of the acute angles is the compliment of the other.

Let a and b be the sides, c the hypothenuse, and A the angle opposite the side a.

By (8.) we have

$$\frac{a}{c}=\sin. A,\ \frac{b}{c}=\cos. A,\ \because \frac{a}{b}=\tan. A,\ \frac{b}{a}=\cot. A.;$$

and by plane geometry, $a^2+b^2=c^2$.

These equations are sufficient for the solution of all cases of right-angled triangles. All questions as to their solution must come under some of the following four:

1°. *Given the two sines, to find the hypothenuse and either angle.*

$$c=\sqrt{a^2+b^2},\quad \because lc=\tfrac{1}{2}l(a^2+b^2)^*,$$

$$\tan. A=\frac{a}{b},\quad \because l.\tan. A=la-lb.$$

2°. *Given the hypothenuse and one side, to find the other side and either angle.*

$$a=\sqrt{c^2-b^2},\ \because la=\tfrac{1}{2}l(c+b)+\tfrac{1}{2}l(c-b),$$

$$\sin. B=\frac{b}{c}\qquad \because l.\sin. B=lb-lc,$$

$$\cos. A=\frac{b}{c}\qquad \because l\cos. A=lb-lc.$$

3°. *Given the hypothenuse and one angle, to find the two sides.*

$$b=c\sin. B,\qquad a=c\cos B,$$

$$\because lb=lc+l\sin. B,\qquad la=lc+l\cos. B.$$

4°. *Given either side and an angle, to find the hypothenuse and the other side.*

$$c=\frac{b}{\sin. B}=\frac{b}{\cos. A},\quad a=\frac{b}{\tan. B}=\frac{b}{\cot. A},$$

$$\because lc=lb-l\sin. B=lb-l\cos. A,$$

$$la=lb-l\tan. B=lb-l\cot. A.$$

The Solution of Oblique Angled Triangles.

(29.) Let a, b, c, be the three sides, and A, B, C, the angles opposed to them respectively. Let p be the perpendicular from any angle A on the opposite side a. We have obviously $\sin. B=\frac{p}{c}$ $\sin. C=\frac{p}{b}$.

Elminating p, we obtain $\frac{\sin. B}{\sin. C}=\frac{b}{c}$,

and, in like manner, $\frac{\sin. C}{\sin. A}=\frac{c}{a}$, $\frac{\sin. A}{\sin. B}=\frac{a}{b}$.

Hence "the sides of a plane triangle are as the sines of the opposite angles."

From the formula $\frac{\sin. A}{\sin. B}=\frac{a}{b}$,

we deduce $\frac{\sin. A+\sin. B}{\sin. A-\sin. B}=\frac{a+b}{a-b}$,

which by [18] becomes $\frac{a+b}{a-b}=\frac{\tan. \frac{1}{2}(A+B)}{\tan. \frac{1}{2}(A-B)}$.

(30.) Let t be the segment of the side t between the perpendicular p and the angle C. By the definitions we have $t=a\cos. C$. But also $C^2=p^2+(b-t)^2=p^2+b^2+t^2-2bs$. But $a^2=p^2+t^2$: : $c^2=a^2+b^2-2ab\cos. C$.

By adding the equations

$$c^2=a^2+b^2-2ab\cos. C.$$

$$0=2ab-2ab,$$

we obtain

$$c^2=(a+b)^2-2ab(1+\cos. C),$$

$$\text{or } c^2=(a-b)^2+2ab(1-\cos. C).$$

Hence by [25]

$$4ab\cos.^2\tfrac{1}{2}C=(a+b)^2-c^2,$$

$$4ab\sin.^2\tfrac{1}{2}C=-(a-b)^2+c^2.$$

By multiplying and dividing these, observing the equation

$$\sin. C=2\sin. \tfrac{1}{2}C\cos. \tfrac{1}{2}C,$$

we obtain

$$4a^2b^2\sin.^2C=[(a+b)^2-c^2]\times[-(a-b)^2+c^2],$$

$$\tan.^2\tfrac{1}{2}C=\frac{-(a-b)^2+c^2}{(a+b)^2-c^2}.$$

All these results may be easily adapted for logarithmic calculation. Let

$$2s=a+b+c,$$

$$\because 2(s-a)=b+c-a,$$

$$2(s-b)=a+c-b,$$

$$2(s-c)=b+a-c.$$

Also

$$(a+b)^2-c^2=(a+b+c)(a+b-c),$$

$$-(a-b)^2+c^2=(a+c-b)(c+b-a).$$

Hence the four equations already obtained, when divided by $4ab$, give

$$\cos.^2\tfrac{1}{2}C=\frac{s(s-c)}{ab},$$

$$\sin.^2\tfrac{1}{2}C=\frac{(s-a)(s-b)}{ab}$$

$$\sin.^2C=\frac{4s.(s-a)(s-b)(s-c)}{a^2b^2}$$

$$\tan.^2\tfrac{1}{2}C=\frac{(s-a)(s-b)}{s(s-c)},$$

which are all suited to logarithmic computation.

(30.) The formulæ which we have now established are sufficient for the solution of oblique plane triangles. The data in all such problems may be reduced to the following:

1°. Given two sides and the angle opposite to one of them.

2°. Given two sides and the angle included by them.

3°. Given two angles and the side opposite to one of them.

4°. Given two angles and the side between them.

5°. Given the three sides.

We shall consider these problems successively.

1°. Let a and b be the given sides, and A the given angle.

---

* The radius should be introduced when it is not = 1 (as here supposed.)

$$\sin.\mathrm{B} = \frac{b}{a}\sin.\mathrm{A}, \qquad \therefore l\sin.\mathrm{B} = lb + l\sin.\mathrm{A} - la.$$

By this formula, sin. B becomes known, but, except in certain cases, the angle B will be equivocal. Since an angle and its supplement have the same sine, and neither necessarily exceeding two right angles, they may be each an angle of a triangle; therefore we can only determine that B is either of two angles which are known and supplemental, but it is in general impossible to decide which it is.

If $b < a$, the angle B must be acute. It may therefore be found in this case.

If it happen to be known that $b < c$, though c itself be not known, the same conclusion follows.

The angle B being computed, the angle C becomes known, and thence the side c may be computed by

$$c = \frac{\sin.\mathrm{C}}{\sin.\mathrm{A}}\cdot a.$$

2°. To compute the angles it is only necessary that the ratio of the sides be given. Let this ratio be $a : b$. By (29) we have

$$\tan.\tfrac{1}{2}(\mathrm{A}-\mathrm{B}) = \frac{a-b}{a+b}\tan.\tfrac{1}{2}(\mathrm{A}+\mathrm{B}).$$

The value of A + B is found by subtracting C from 180°. Hence A—B becomes known by the preceding formula, and from this and A+B the values of A and B are derived.

Having found A and B, C may be determined by

$$\sin.c = a\frac{\sin.\mathrm{C}}{\sin.\mathrm{A}}$$

3°. Let the angles be A, B, and the given side a.

Hence
$$b = a\frac{\sin.\mathrm{B}}{\sin.\mathrm{A}},$$
$$c = a\frac{\sin.(\mathrm{A}+\mathrm{B})}{\sin.\mathrm{A}}$$

The angle C is determined by

$$\mathrm{C} = \pi - \mathrm{A} - \mathrm{B}.$$

4°. Since the two given angles determine the third angle, this case is reduced to the last.

5°. This problem may be solved by any of the four formulæ determined in (30.), and which are all suited to logarithms.

SPHERICAL TRIGONOMETRY.

SECTION I.

Of Circles on a Spherical Surface.

(1.) By the principles of solid geometry it is proved that if a sphere be intersected by a plane, the section is a circle. If the plane pass through the centre of the sphere, the section is called a *great circle;* if not, it is a *lesser circle.*

(2.) That diameter of the sphere, which is perpendicular to the plane of any circle of the sphere, is called the *axis* of that circle, and the extremities of this diameter are called the *poles* of the circle.

(3.) A great circle, whose plane is perpendicular to any circle, is said to be *secondary* to it. It is evident that the planes of all secondaries to a circle pass through its axis, and their circumferences pass through its poles.

(4.) *All great circles bisect each other, and a secondary bisects all parallels to its primary.*

1°. The intersection of the planes of two great circles is necessarily a diameter of the sphere, and a common diameter of both circles. Hence they necessarily bisect each other.

2°. By (3.) the plane of a secondary passes through the axis of its primary, and therefore through the centres of all parallels to the primary. Hence it bisects all such parallels.

(5.) *The angle under two great circles is equal to the angle under their planes.*

The intersection of the planes of two great circles is the common diameter joining the points of intersection of their circumferences. Tangents to the circles drawn from these points of intersection are necessarily in the planes of the circles and perpendicular to their common diameter; hence the angle under these tangents is at the same time the angle under the circles, and the angle under their planes.

(6.) *The angle under two great circles is equal to the distance between their poles.*

The axes of the great circles being perpendicular to their planes are inclined at the same angle as the planes of the circles. But the angle under the axes is obviously measured by the arc which joins their extremities, that is, by the distance between the poles of the great circles.

(7.) *The angle under two great circles is measured by the arc of a common secondary intercepted between them.* For this arc and the distance between the poles have a common complement.

SECTION II.

Of Spherical Triangles.

(8.) *Def.* Three points upon the surface of a sphere being connected by arcs of great circles, the figure formed on the surface by these arcs is called a spherical triangle.

(9.) *Any two sides of a spherical triangle taken together are greater than the third side.*

For if the radii of the sphere be drawn to the three angles, they will form at the centre a solid angle bounded by three plane angles which are equal to the sides of the proposed triangle. It is proved (Eucl. lib. xi. prop. 20), that any two angles forming such a solid angle must be together greater than the third.

(10.) *The sum of the three sides of a spherical triangle is less than the circumference of a great circle.*

For let any two of the sides a, b, be produced through the third side c until they meet again. The produced parts $\pi - a$ and $\pi - b$ will, with the third side c, form a triangle. Hence by the last proposition,

$$\pi - a + \pi - b > c,$$
$$\therefore 2\pi > a + b + c.$$

(11.) *If the intersections of three great circles be the poles of three others, the intersections of the latter will be the poles of the former.*

Let a, b, c, be three great circles, and a', b', c',

three others. The intersections of a and b are the poles of c', ∵ the intersection of the planes of a and b is the axis of c' and is perpendicular to every line in the plane of c'. Therefore it is perpendicular to the intersection of the planes of a' and c'.

Also, for the same reason, the intersection of the planes of b and c is perpendicular to the intersection of the planes of c' and a'. Since then the intersection of the planes of c' and a' is perpendicular to the intersection of the planes of b and c, and also to that of the planes b and a, it is perpendicular to two lines in the plane b, and is therefore perpendicular to the plane b itself. Euc. lib. xi. Hence the intersection of the planes a' and c' is the axis of b, and the intersections of the circles a' and c' are therefore the poles of b.

In like manner it may be proved that the intersections of b' and c' are the poles of a, and those of a' and b' the poles of c.

(12.) *If the poles of the sides of a spherical triangle be joined by arcs of great circles, the sides of the triangle so found will be equal to the angles of the former, and vice versa.*

Let a, b, c, be the sides of the first, and A, B, C, the angles. By (6.) the sides of the second triangle must be equal to the supplements of the angles of the first, and by (11.) the sides of the first must be equal to the supplements of the angles of the second.

Two triangles thus related are called polar triangles.

(14.) *Def.* Two semicircles being described upon the same diameter of a sphere, that part of the surface of the sphere which they include is called a lune.

(15.) *Def.* The common diameter of the semicircles is called the *axis* of the lune.

(16.) *Def.* The angle under the planes of the semicircles is called the *angle* of the lune.

(17.) *Lunes of the same sphere, whose angles are equal, have equal surfaces.*

For if their axes be supposed to be placed in coincidence as well as the planes of two of their semicircles, the planes of the other two semicircles being turned in the same direction, must coincide, since the angles of the lunes are equal. Therefore the semicircles which bound the lunes will coincide, and therefore their surfaces will necessarily also coincide and be equal.

(18.) *Given the surface of the sphere and the angle of a lune, to determine its area.*

Let α be the angle of the lune and S the surface of the sphere. Let the angle α be divided into any number of parts n. It is plain that the lune may be divided into a number (n) of equal lunes; the angles of which will be $\frac{\alpha}{n}$. Now as often as $\frac{\alpha}{n}$ is contained in 360 degrees, so often will one of these lunes be contained in the whole surface of the sphere. Hence it appears that the lune whose angle is α, bears to the surface S the ratio $\alpha : 360°$. If L be the lune

$$L = S\,\frac{\alpha}{360°} = S.\,\frac{\alpha}{2\pi}.$$

The surface of a sphere is proved to be equal to four times the area of one of its great circles. Hence,

$$S = 4r^2\pi,$$

$$\therefore L = 2r^2\alpha.$$

(19.) *Cor.* 1. Lunes of the same sphere are as their angles.

(20.) *Cor.* 2. Lunes of different spheres are as the products of their angles and the squares of their axes.

(21) *Cor.* 3. The whole surface of the sphere consists of four rectangular lunes.

(22.) *Cor.* 4. A secondary to the sides of a lune divides it into two equal rectangular isoceles triangles, whose vertical angles are those of the lune.

(23.) *Given the surface of the sphere, to determine the area of a given triangle.*

Let each pair of sides of the triangle be produced through the extremities of the third side until they intersect. There will thus be three lunes formed, whose angles will be the three angles of the triangle, and their surfaces respectively will be

$$2r^2A, \qquad 2r^2B, \qquad 2r^2C,$$

r being the radius of the sphere, and A, B, C, the angles of the triangle (171.)

In the surfaces of these lunes the given triangle is three times repeated, and with it three of the eight triangles into which the whole sphere is divided by the circles which form the given triangle. The surface of the hemisphere is equal to those three triangles together with the given one. Hence the sum of the three lunes exceed the hemisphere by twice the area of the given triangle. Therefore, if D be the area of the triangle

$$D = r^2(A + B + C) - r^2\pi,$$

$$\therefore D = r^2[(A + B + C) - \tau.]$$

Hence the area of a spherical triangle is equal to that of a lune of the same sphere whose angle is equal to half the excess of the sum of the three angles of the triangle above two right angles.

In the formula just obtained, the angles A, B, C, π, are related to the radius unity.

If they should be expressed in seconds, it will be necessary to divide each angle by 206265 (4.)

(24.) Cor. 1. The areas of triangles on the surface of the same sphere are proportional to the excess of the sums of their angles above two right angles.

SECTION III.

Trigonometrical Formulæ expressing relations between the Sides and Angles of a Spherical Triangle.

(25.) The analytical formulæ which expresses all the various trigonometrical relations of the sides and angles of a spherical triangle, although very numerous, and many of them apparently unconnected, may, nevertheless, be all derived from one formula, which may be considered as the foundation of the whole structure of spherical trigonometry. This formula, therefore, may be regarded in spherical trigonometry in the same point of view as that for the sine of the sum of two arcs in plane trigonometry, and, as in that case, we shall establish it by geometrical construction, and subsequently derive all others from it.

Let a, b, c, be the sides, and A, B, C, the angles of a spherical triangle, as usual. From the vortex of the angle C let tangents be drawn to the arcs a and b; and from the centre of the sphere let the radii through the vertices of the angles A and B be drawn and produced to meet the tangents; and let the points where they meet the tangents be connected by a right line D. The produced radii are evidently the secants of the sides a, b, the radius of the sphere being unity, and the parts of the tangents intercepted between the secants and the vertex of C are the tangents of the sides. The angle under the tangents is equal to C, and that under the secants to c.

By applying the principle (75.) to the two plane triangles of which D is a common side, and of which the remaining sides are the tangents and secants of a and b, we obtain

$$D^2 = \tan.^2a+\tan.^2b - 2\tan.a\tan.b\cos.C.$$

$$D^2 = \sec.^2a+\sec.^2b - 2\sec.a\sec.b\cos.c.$$

Subtracting the former from the latter, and observing the conditions.

$$\sec.^2a - \tan.^2a = 1,$$

$$\sec.^2b - \tan.^2b = 1,$$

$$\sec.a\sec.b = \frac{1}{\cos.a\cos.b},$$

$$\tan.a\tan.b. = \frac{\sin.a\sin.b}{\cos.a\cos.b},$$

we obtain

$$\cos.a\cos.b + \sin.a\sin.b\cos.C - \cos.c = 0.$$

This principle being successively applied to each of the three angles A, B, C, gives a system of three formulæ, which may be expressed thus:

$$\cos.\left|\begin{matrix}a\\b\\c\end{matrix}\right. - \cos.\left|\begin{matrix}A\\B\\C\end{matrix}\right.\sin.\left|\begin{matrix}b\\c\\a\end{matrix}\right.\sin.\left|\begin{matrix}c\\a\\b\end{matrix}\right. - \cos.\left|\begin{matrix}b\\c\\a\end{matrix}\right.\cos.\left|\begin{matrix}c\\a\\b\end{matrix}\right. = 0 \quad [1,]$$

which formulæ are the foundation of spherical trigonometry.

(26.) By [1]

$$\left.\begin{aligned}&\cos.a - \cos.A\sin.b\sin.c - \cos.b\cos.c = 0,\\&\cos.(b \pm c) \pm \sin.b\sin.c - \cos.b\cos.c = 0,\end{aligned}\right\}$$

$$\left.\begin{aligned}&\cos.(b+c) - \cos.a + \sin.b\sin.c(1+\cos.A) = 0,\\&\cos.(b-c) - \cos.a - \sin.b\sin.c(1-\cos.A) = 0.\end{aligned}\right\}$$

$$\cos.(b+c) - \cos.a = 2\sin.\tfrac{1}{2}(a+b+c)\sin.\tfrac{1}{2}(b+c-a),$$

$$\cos.(b-c) - \cos.a = 2\sin.\tfrac{1}{2}(a+b-c)\sin.\tfrac{1}{2}(a+c-b),$$

$$1+\cos.A = 2\cos.^2\tfrac{1}{2}A, \qquad 1-\cos.A = 2\sin.^2\tfrac{1}{2}A.$$

Hence, if

$$s = \tfrac{1}{2}(a+b+c), \quad \therefore (s-a) = \tfrac{1}{2}(b+c-a),$$

$$(s-b) = \tfrac{1}{2}a+c-b, \quad (s-c) = \tfrac{1}{2}(a+b-c),$$

we obtain

$$\left.\begin{aligned}&\sin.b\sin.c\cos.^2\tfrac{1}{2}A = \sin.s\sin.(s-a)\\&\sin.b\sin.c\sin.^2\tfrac{1}{2}A = \sin.(s-b)\sin.(s-c)\\&\sin.^2b\sin.^2c\sin.^2A = 4\sin.s\sin.(s-a)\sin.(s-b)\\&\quad\sin.(s-c)\\&\tan.^2\tfrac{1}{2}A = \frac{\sin.(s-b)\sin.(s-c)}{\sin.s\sin.(s-a)}\end{aligned}\right\}[2]$$

It is evident that four formulæ analogous to these are applicable to each of the three angles, and may be derived from these by merely changing the letters.

(27.) By the third of the group [2] we obtain

$$\sin.A = \frac{2[\sin.s\sin.(s-a)\sin.(s-b)\sin.(s-c)]^{\frac{1}{2}}}{\sin.b\sin.c},$$

$$\frac{\sin.A}{\sin.a} = \frac{2[\sin.s\sin.(s-a)\sin.(s-b)\sin.(s-c)]^{\frac{1}{2}}}{\sin.a\sin.b\sin.c} \quad [3]$$

This formula being a symmetrical function of the sides of the triangle will remain unchanged, if b be changed into a or c, and *vice versa*. Hence we infer in general, that

$$\frac{\sin.A}{\sin.a} = \frac{\sin.B}{\sin.b} = \frac{\sin.C}{\sin.c} \quad . \quad . \quad . \quad . \quad . \quad . \quad [4];$$

(28.) By [2]

$$\sin.^2\tfrac{1}{2}A = \frac{\sin.(s-b)\sin.(s-c)}{\sin.b\sin.c}$$

$$\cos.^2\tfrac{1}{2}A = \frac{\sin.s\sin.(s-a)}{\sin.b\sin.c},$$

$$\sin.^2\tfrac{1}{2}B = \frac{\sin.(s-a)\sin.(s-c)}{\sin.a\sin.c},$$

$$\cos.^2\tfrac{1}{2}B = \frac{\sin.s\sin.(s-b)}{\sin.a\sin.c},$$

which, with

$$\sin.\tfrac{1}{2}(A \pm B) = \sin.\tfrac{1}{2}A\cos.\tfrac{1}{2}B \pm \sin.\tfrac{1}{2}B\cos.\tfrac{1}{2}A,$$

$$\sin.a\sin.b\cos.^2\tfrac{1}{2}C = \sin.s\sin.(s-c),$$

$$\sin.(s-b)+\sin.(s-a) = 2\sin.\tfrac{1}{2}c\cos.\tfrac{1}{2}(a-b),$$

$$\sin.(s-b)-\sin.(s-a) = 2\cos.\tfrac{1}{2}c\sin.\tfrac{1}{2}(a-b),$$

give

$$\left.\begin{aligned}&\sin.\tfrac{1}{2}(A+B) = \frac{\cos.\frac{1}{2}C}{\cos.\frac{1}{2}c}\cos.\tfrac{1}{2}(a-b)\\&\sin.\tfrac{1}{2}(A-B) = \frac{\cos.\frac{1}{2}C}{\sin.\frac{1}{2}c}\sin.\tfrac{1}{2}(a-b)\end{aligned}\right\} \quad . \quad [5].$$

(29.) By a process precisely similar, we obtain

$$\left.\begin{aligned}&\cos.\tfrac{1}{2}(A+B) = \frac{\sin.\frac{1}{2}C}{\cos.\frac{1}{2}c}\cos.\tfrac{1}{2}(a+b)\\&\cos.\tfrac{1}{2}(A-B) = \frac{\sin.\frac{1}{2}C}{\sin.\frac{1}{2}c}\sin.\tfrac{1}{2}(a+b)\end{aligned}\right\} \quad . \quad [6].$$

(30.) By dividing the formulæ of [5] by those of [6] respectively, we obtain

$$\left.\begin{aligned}&\tan.\tfrac{1}{2}(A+B) = \frac{\cos.\frac{1}{2}(a-b)}{\cos.\frac{1}{2}(a+b)}\cot.\tfrac{1}{2}C\\&\tan.\tfrac{1}{2}(A-B) = \frac{\sin.\frac{1}{2}(a-b)}{\sin.\frac{1}{2}(a+b)}\cot.\tfrac{1}{2}C\end{aligned}\right\} \quad . \quad [7].$$

(31.) The polar triangles furnish a rule by which every group of formulæ expressing relations between the sides and angles of a spherical triangle can be converted into another group giving other relations between the same quantities. Any formula may be applied to the polar triangle by changing the sides into the supplements of the angles, and *vice versa.* But since the sine and cosecant of the supplement of an angle are the same as those of the angle itself, and the cosine, tangent, cotangent, and secant of the supplement only differ from those of the angle itself in sign, it follows that it is allowed in any formulæ to change a, b, c, into A, B, C, and *vice versa*, provided that the signs of all cosines, tangents, cotangents, and secants, be changed.

The changes thus indicated being effected upon all the formulæ which have been established in this section, the result will be a series of analogous formulæ.

It may be observed in general, that if a formula be a symmetrical function of the sides and angles, this change in the parts produces no change in the whole.

This observation applies to [4.]

To make this transformation on [2,] [3,] [7,] let

$$S = \tfrac{1}{2}(A + B + C);$$

and let the sides and angles of the supplemental polar triangle be

$$a', b', c',$$
$$A', B', C',$$
$$a' + A = \pi, \quad b' + B = \pi, \quad c' + C = \pi,$$
$$A' + a = \pi, \quad B' + b = \pi, \quad C' + c = \pi.$$

Hence

$$\sin.a' = \sin.A, \ \ \sin.b' = \sin \sin.B', \ \ \sin.c' = \sin.C,$$
$$\sin.\tfrac{1}{2}A' = \cos.\tfrac{1}{2}a, \ \cos.\tfrac{1}{2}A' = \sin.\tfrac{1}{2}a, \ \tan.\tfrac{1}{2}A' = \cot.\tfrac{1}{2}a,$$
$$s' = \frac{3\pi}{2} - s, \ s' - a' = \frac{\pi}{2} - (S - A,) s' - a' = \frac{\pi}{2} - (S - A,)$$
$$s' - b' = \frac{\pi}{2} - (S - B,) \quad s' - c' = \frac{\pi}{2} - (S - C.)$$

Hence

$$\cos.\left|\begin{matrix}A\\B\\C\end{matrix}\right. - \cos.\left|\begin{matrix}a\\b\\c\end{matrix}\right. \sin.\left|\begin{matrix}B\\C\\A\end{matrix}\right. \sin.\left|\begin{matrix}C\\A\\B\end{matrix}\right. + \cos.\left|\begin{matrix}B\\C\\A\end{matrix}\right. \cos.\left|\begin{matrix}C\\A\\B\end{matrix}\right. = 0 \ [8].$$

$$\sin.B.\sin.C.\cos.^2\tfrac{1}{2}a = \cos.(S - B)\cos.(S - C)$$
$$\sin.B.\sin.C.\sin.^2\tfrac{1}{2}a = -\cos.S.\cos.(S - A)$$
$$\sin^2 B \sin^2.C.\sin^2 a = -4\cos.S\cos.(S - A)\cos.(S - B)\cos.(S - C)$$
$$\cot.^2\tfrac{1}{2}a = -\frac{\cos.(S - B)\cos.(S - C)}{\cos.S.\cos.(S - A)}$$
$$\frac{\sin.a}{\sin.A} = \frac{2\left[-\cos.S.\cos.(S - A\cos.)(S - B)\cos.(S - C)\right]^{\frac{1}{2}}}{\sin.A\sin.B\sin.C}$$

$$\left.\begin{aligned}\tan.\tfrac{1}{2}(a + b) &= \frac{\cos.\frac{1}{2}(A - B)}{\cos.\frac{1}{2}(A + B)}\tan.\tfrac{1}{2}c\\ \tan.\tfrac{1}{2}(a - b) &= \frac{\sin.\frac{1}{2}(A - B)}{\sin.\frac{1}{2}(A + B)}\tan.\tfrac{1}{2}c\end{aligned}\right\} \cdot [11].$$

The formulæ [7] and [11] are called "Napier's Analogies," that mathematician having been the first to establish them, and to apply them to the solution of spherical triangles.

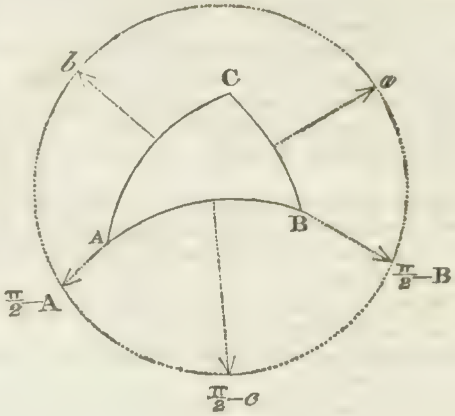
SECTION V.

On the Solution of Right Angled Spherical Triangles. Napier's rules.

(32.) In a right angled spherical triangle there are five quantities which may become the objects of computation, scil. two angles and three sides. Any two of these five quantities being known or discoverable, the other three may, in general, be computed. The solution of right angled triangles, therefore, is resolved into as many cases as there are different combinations of two to be made from five, which are $\frac{5.4}{1.2} = 10$.

To retain the necessary formulæ for these ten cases in the memory would be attended with some difficulty. Napier has, however, by a very ingenious contrivance reduced the ten cases to two, and these so striking and simple, that, when once understood, they will not easily be forgotten. We shall first explain these two celebrated *rules*, and then show that they comprise all the cases.

Let ABC be a spherical triangle right angled at C, and let the sides and angles be expressed as hitherto. Let the triangle be imagined to be placed within a circle, which is merely used to mark the order of certain quantities, to which, and to their order thus determined, we shall have occasion to refer. Opposite to the arrows which point from the sides to the surrounding circle are placed a. b, and $\frac{\pi}{2} - c$, that is, the sides and the complement of the hypothenuse. Opposite to the arrows which point from the angles are $\frac{\pi}{2} - A$, and $\frac{\pi}{2} - B$, that is, the complements of the angles. These quantities which thus surround the circle are called *circular parts.* Any one of these being taken as *middle part* (M,) those which are next to it on each side going round the circle are called *adjacent extremes* (A, A'); and the remaining two are called *opposite extremes* (O, O'). Thus, if $\frac{\pi}{2} - A$ be the middle part, the adjacent extremes will be $\frac{\pi}{2}$ c and b; and the opposite extremes $\frac{\pi}{2} - B$ and a.



We shall now prove that the two following formulæ are true, and include all the ten cases before mentioned:

$$\sin.M = \tan.A \tan.A',$$
$$\sin.M = \cos.O \cos.O'.$$

These are called *Napier's rules*, and are generally announced thus:

1. "The rectangle under the radius and the sine of the middle part is equal to the rectangle under the tangents of the adjacent extremes."
2. "The rectangle under the radius and the sine of the middle part is equal to the rectangle under the cosines of the opposite extremes."

The radius being unity does not appear in the formulæ.

Taking each of the five circular parts as middle successively, and making the proper substitutions in the above formulæ, we obtain the ten following equations; which solve the ten cases of right-angled triangles, and are adapted to logarithmic computation.

$$1. \ \cos.c = \cot.A \cot.B.$$

2. $\cos.c = \cos.a \cos.b.$
3. $\sin.a = \sin.c \sin.A.$
4. $\sin.b = \sin.c \sin.B.$
5. $\cos.A = \cos.a \sin.B.$
6. $\cos.B = \cos.b \sin.A.$
7. $\cos.A = \tan.b \cot.c.$
8. $\cos.B = \tan.a \cot.c.$
9. $\sin.a = \tan.b \cot.B.$
10. $\sin.b = \tan.a \cot.A.$

SECTION VI.

Solution of Oblique Angled Spherical Triangles.

(33.) In spherical triangles there are six quantities, any three of which being given, the other three may, in general, be computed, the three angles being sufficient data, which is not the case in plane triangles. There would then be as many distinct systems of data in the solution of oblique spherical triangles as there could be combinations of three made from six $= \frac{6.5.4}{1.2.3} = 20$. They may be, however, reduced to a smaller number of more comprehensive classes. It is obvious that the three data must always come under some one of the following systems:

I. The three sides.
II. The three angles.
III. Two sides and the included angle.
IV. Two angles and the included side.
V. Two sides and the angle opposite one of them.
VI. Two angles and the side opposite one of them.

We shall consider these cases successively.

I. *Given the three sides.*

The values of the angles may be determined by four distinct formulæ deduced from the results of (26 et. seq.) as follow:

$$1^\circ.\ \sin.\tfrac{1}{2}A = \sqrt{\frac{\sin.(s-b)\sin.(s-c)}{\sin.b \sin.c}},$$

$$2^\circ.\ \cos.\tfrac{1}{2}A = \sqrt{\frac{\sin.s \sin.(s-a)}{\sin.b \sin.c}}.$$

$$^\circ.\ \sin.A = \frac{2}{\sin.b \sin.c}\sqrt{\sin.s \sin.(s-a)\sin.(s-b)\sin.(s-c)}.$$

$$4^\circ.\ \tan.\tfrac{1}{2}A = \sqrt{\frac{\sin.(s-b) \sin.(s-c)}{\sin.s \sin.(s-a)}}.$$

These formulæ are all suited to logarithmic calculation.

II. *Given the three angles.*

In this case, like the last, the sides may be determined by any one of four formulæ deduced from the results of (31).

$$1^\circ.\ \sin.\tfrac{1}{2}a = \sqrt{\frac{-\cos.S \cos.(S-A)}{\sin.B \sin.C}}.$$

$$2^\circ.\ \cos.\tfrac{1}{2}a = \sqrt{\frac{\cos.(S-B)\cos.(S-C)}{\sin.B \sin.C}}.$$

$$= \frac{2}{\sin.B \sin.C}\sqrt{-\cos.S \cos.(S-A)\cos.(S-B)\cos(S-C.)}$$

$$4^\circ.\ \cot.\tfrac{1}{2}a = \sqrt{\frac{\cos.(S-B) \cos.(S-C)}{\cos.S \cos.(S-A)}}.$$

III. *Given two sides and the included angle.*

$$\left.\begin{aligned}\tan.\tfrac{1}{2}(A+B) &= \frac{\cos.\frac{1}{2}(a-b)}{\cos.\frac{1}{2}(a+b)}\cot.\tfrac{1}{2}C\\ \tan.\tfrac{1}{2}(A-B) &= \frac{\sin.\frac{1}{2}(a-b)}{\sin.\frac{1}{2}(a+b)}\cot.\tfrac{1}{2}C\end{aligned}\right\}.$$

Having determined the sum and difference of the remaining angles by any of these systems, the angles may be immediately found by addition and subtraction.

To determine the remaining side c, having previously determined the angles A, B, as above, we have the formula

$$\sin.c = \frac{\sin.a}{\sin.A}\sin.C.$$

IV. *Given two angles and the included side.*

$$\left.\begin{aligned}\tan.\tfrac{1}{2}(a+b) &= \frac{\cos.\frac{1}{2}(A-B)}{\cos.\frac{1}{2}(A+B)}\tan.\tfrac{1}{2}c.\\ \tan.\tfrac{1}{2}(a-b) &= \frac{\sin.\frac{1}{2}(A-B)}{\sin.\frac{1}{2}(A+B)}\tan.\tfrac{1}{2}c.\end{aligned}\right\}$$

The sum and difference of the sides being found, the sides themselves can be determined by addition and subtraction.

To determine the remaining angle, having previously determined the side a or b as above, we have

$$\sin.C = \frac{\sin.A}{\sin.a}\sin.c, \qquad \sin.C = \frac{\sin.B}{\sin.b}\sin.c.$$

V. *Given two sides and the angle opposed to one of them.*

(251.) Let the sides be a, b, and the angle A.

To determine the angle B, we have the equation

$$\sin.B = \frac{\sin.b}{\sin.a}\sin.A = m\sin.A.$$

Since an angle is to be determined in this case from its sine, the result is equivocal; the sine being common to an angle and its supplement.

To determine the side c, we have

$$\cos.a = \cos.b \cos.c + \sin.b \sin.c \cos.A,$$

$$\therefore \frac{\cos.a}{\cos.b} = \cos.c + \tan.b \sin.c \cos.A.$$

Let

$$\tan.b \cos.A = \tan\theta,$$

$$\therefore \frac{\cos.a}{\cos.b} = \frac{\cos.c \cos.\theta + \sin.c \sin.\theta}{\cos.\theta}.$$

Let ϕ be the difference between c and θ. Hence

$$\cos.\phi = \cos.\theta\frac{\cos.a}{\cos.b}.$$

The side c is the sum or difference of ϕ and θ.

The side c being found, the angle C may be determined by the first case.

VI. *Given two angles and the side opposed to one of them.*

Let the angles be A, B, and the side a.

To determine b, we have

$$\sin.b = \frac{\sin.B}{\sin.A}\sin.a$$

The result is also equivocal in this case, and for the same reasons as in the last.

To determine the angle C, we obtain by the supplemental triangle

$$\cos.\theta = \tan.B \cos.a,$$

$$\frac{\cos.A}{\cos.B} = \frac{\sin.C \cos.\theta - \sin.\theta \cos.C}{\sin.\theta},$$

$$\sin.(C - \theta) = \sin.\theta \frac{\cos.A}{\cos.B}.$$

The angle C being determined, the side *c* may be found by the second case.

SECTION VII.

On the Relations between the small Variations in the Sides and Angles of Triangles.

(34.) We have already shown, that in all determinate problems respecting the solution of triangles, it is indispensably necessary that three of the six parts of the triangle should be known, and in plane triangles, one at least of three must be a side. In practice, these data, always obtained originally by observation and measurement, are liable to error from obvious and inevitable causes. It is true that, from the great excellence of instruments, and the almost inconceivable accuracy of modern observation, these errors are extremely minute, yet, in cases where great precision is requisite, it becomes necessary to determine the effects which small errors in the data will produce upon the computed quantities, and to select the data and quæsita in such a manner, that given errors in the one shall entail upon the other the smallest possible errors.

The principles of the differential calculus present easy means for attaining this end. Let us suppose that of the three data, two have been obtained with sufficient accuracy, but the third, x, is liable to an error of a given amount, which we shall call h. Let u be the sought quantity. Two of the three data being considered constant, the sought quantity u may be considered as a function of the third, x, so that

$$u = F(x).$$

The quantity x becoming $x + h$, let the quantity u become u', we have

$$u' = F(x + h)$$

$$\therefore u' - u = A_1 \frac{h}{1} + A_2 \frac{h_2}{1.2} + A_3 \frac{h^3}{1.2.3} + \cdots$$

where A_1, A_2, A_3, ... are the successive differential co-efficients of $F(x)$.

If x be supposed to represent the true value of that part of the triangle which is liable to the error h, then $x+h$ will be the quantity given by observation, and u will be the true value of the sought quantity, and u' its computed value. Hence $u' - u$ is the error sought, which is therefore represented by the above series. Since h in practice is always a very small quantity, this series converges rapidly, and therefore a small number of its initial terms may be assumed as equivalent to the whole, without sensible error. The number of terms to be taken for the whole depends entirely on the magnitude of the error h. In most cases it is sufficient to take the first term only, but in case h be not extremely small, or if more than ordinary accuracy be requisite, the first two terms are taken; this, however, is seldom necessary, so that we may in general assume

$$u' - u = A_1 h,$$

which gives the following rule for determining the error in a computed quantity, produced by a small error in one of the given quantities from whence it is derived:

Let the computed quantity be expressed as a function of the given quantity, and let the differential co-efficient be found with respect to the given quantity as a variable, the error in the computed quantity will be determined by multiplying the error in the given quantity by this differential co-efficient.

If two of the data be liable to given errors, the effect upon the sought quantity may be computed on similar principles, by considering the sought quantity as a function of the two data so liable to error, and differentiating it with respect to these as two independent variables; the differential of the sought quantity thus found will represent the error to which it is liable, the differentials of the data representing their respective errors which are supposed to be very small and given.

It is evident that the same method extends to the case where all the data are liable to given small errors. In this case the sought quantity is to be regarded as a function of three variables, and its differential found as before.

The principles which have just been established furnish a method by which, when a triangle plane or spherical is subject to minute variations in its sides or angles, the relation between these variations and the sides and angles themselves may always be investigated and expressed by equations, so that when there are sufficient data, any one of the variations may be derived from the others.

The following examples will illustrate the application of this principle.

To determine the relation between the minute variations of the side of a plane right-angled triangle and the opposite angle, the remaining side being considered constant.

Let a and A be the side and angle which are subject to variation, and b the constant side.

$$a = b\tan.A, \quad \therefore da = b\sec.^2 A dA,$$

which is the variation sought. To determine this for any given value of a, let b be eliminated by the two equations, and the result is

$$da = a(\cot.A + \tan.A)dA. = \frac{2a}{\sin.2A} dA.$$

Two sides of a plane triangle being given to investigate the relation between the small variations of the included angle and the opposite side.

Let a and b be the given sides, and C the included angle, $\therefore$

$$c^2 = a^2 + b^2 - 2ab\cos.C$$

$$\therefore cdc = ab \sin.CdC$$

But $\frac{1}{2}ab \sin.C$ being the area of the triangle if p be the perpendicular from C upon c, we have

$$pc = ab\sin.C$$

$$\therefore dc = pdC,$$

which is the relation required.

SECTION VII.

On the Computation of Trigonometrical Tables.

Trigonometrical computation is conducted by the aid of computed tables from which the numerical values of the sines, tangents, &c. of angles referred to some given radius may be found. Of these tables there are two kinds; those in which the immediate values of the sines, &c. are registered, and which are called tables of *natural sines*, &c. and those in which the logarithms of the sines, &c. are registered, and which are called tables of logarithmic sines, &c. It is not proposed here to enter minutely into the details of the methods of constructing trigonometrical tables, but only to point out in a general way the application of the formulæ by which the successive terms of a table may be computed, and the methods of checking the errors, whether of the computist or the printer, in those tables which have been already computed.

It very rarely happens that the values of the sines or cosines of angles can be exactly expressed by integers or finite decimals. An approximation in decimals can, however, be always obtained to any degree of accuracy which may be required. The ordinary tables give the values continued to seven places of decimals; but tables have been computed extending to ten, and even to fifteen decimal places. If the sines of angles, which are nearly equal to 90°, or the cosines of very small angles be required to that degree of approximation which would determine the results to seconds and tenths, it will be necessary to extend the computation to twelve decimal places, the radius being unity.

If we suppose that the series of angles of which the sines and cosines are to be tabulated, are in arithmetical progression the common difference, and the number of places in the approximate values will depend each upon the other. If A be an angle of the table, and x the common difference, then several successive angles of the table will be

$$\text{A} \quad \text{A}+x,\ \text{A}+2x,\ \text{A}+3x \ldots\ldots\ldots\ldots$$

Now if upon calculation it be found that the sines of several of these successive angles agree in the first seven places, it is plain that seven places do not give a sufficient approximation to distinguish angles differing by so small a quantity as x. Let us suppose that the computed value of the sines of A, $\text{A}+x$ and $\text{A}+2x$, were the same as far as seven places, but that the seventh place in sines $(\text{A}+3x)$ were different; it is obvious that in this case it would be useless to tabulate sin. $(\text{A}+x)$, sin. $(\text{A}+2x)$, and that if the approximation be limited to seven places, sin. $(\text{A}+3x)$ should succeed sin. A, and therefore that the common difference should be $3x$; or if the common difference x be retained, the approximation must be continued until the last digit of sin. $(\text{A}+x)$ differ from that of sin. A. It should also be observed, that the degree of approximation necessary to distinguish angles, having a given difference x, also depends on the values of the angles themselves, since the variation of the sine is very slow with respect to the variation of the arc, if it be nearly 90°, and that of the cosine if it be very small. In calculations requiring an extreme degree of accuracy, therefore, it is frequently necessary to compute the values of the sines or cosines to a greater number of places than are given in the tables.

If x be the least angle in the proposed table, and the successive terms be the multiples of x, $2x$, $3x$, $4x$, &c. any three successive tabulated angles will be

$$(n-1)x,\ nx,\ (n+1)x,$$

and we have the relation between their sines and cosines;

$$\text{sin.}(n+1)x = \text{sin.}(n-1)x + 2\text{sin.}x \,\text{cos.}\, nx,$$
$$\text{cos.}(n+1)x = \text{cos.}(n-1)x - 2\text{sin.}x \,\text{sin.}\, nx.$$

By these formulæ, if the first term sin.x be known, and also the sines of $(n-1)x$ and nx, the sine of $(n+1)x$ may be computed. That is, if the first term of the tables, and any two successive terms be known, all the succeeding ones may be computed. By substituting successively 1, 2, 3, ... for n, we obtain

$$\left.\begin{array}{l}\text{sin.}2x = 2\text{sin.}x\,\text{cos.}x\\ \text{cos.}2x = 1 - 2\text{sin.}^2x\end{array}\right\}$$
$$\left.\begin{array}{l}\text{sin.}3x = \text{sin.}x + 2\text{sin.}x\,\text{cos.}2x\\ \text{cos.}3x = \text{sin.}x - 2\text{sin.}x\,\text{sin.}\,2x\end{array}\right\}$$
$$\left.\begin{array}{l}\text{sin.}4x = \text{sin.}2x + 2\text{sin.}x\,\text{cos.}3x\\ \text{cos.}4x = \text{cos.}2x - 2\text{sin.}x.\text{sin.}3x\end{array}\right\}$$

. . . .
. . . .

by which, if the first term of each series be known, all the others may be found.

To determine the first terms, we have

$$\text{sin.}x = \frac{x}{1} - \frac{x^3}{(3)}{}^{*} + \frac{x^5}{(5)} - \frac{x^7}{(7)} + \ldots\ldots$$
$$\text{cos.}x. = 1 - \frac{x^2}{(2)} + \frac{x^4}{(4)} - \frac{x^6}{(6)} + \ldots\ldots$$

As x is always small, these series converge sufficiently to determine sin.x, cos.x, with considerable facility. Thus, if x be one degree = 3600″, we have

$$x = \frac{3600}{206265} = \frac{240}{13751},$$
$$\therefore \text{sin.}x = \frac{240}{13751} - \frac{(240)^3}{(13751)^3\times6} + \frac{(240)^5}{(13751)^3\times120} - \ldots\ldots$$
$$\text{cos.}x = 1 - \frac{(240)^2}{(13751)^2\times2} + \frac{(240)^4}{(13751)^4\times24} \ldots\ldots$$

If x be one minute, we have $x = \frac{60}{206265} = \frac{4}{13751}$, in which case the convergence is still more rapid.

In order that the values expressed in a given number of decimal places should be the nearest possible to the true value, the computation should be continued to a few additional places.

The sines and cosines being found, the tangents, cotangents, secants, and cosecants, may be determined by

$$\text{tan.}x = \frac{\text{sin.}x}{\text{cos.}x}, \qquad \text{cos.}x = \frac{\text{cos.}x}{\text{sin.}x},$$

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[*] The notation (2), (3), (4), &c. is here used to express 1.2, 1.2.3, 1.2.3.4, &c.

$$\text{sec.}x = \frac{1}{\text{cos.}x},\quad \text{cosec.}x = \frac{1}{\text{sin.}x},$$

THE ANALYSIS OF ANGULAR SECTIONS.

SECTION I.

Of Multiple Arcs.

The formulæ which exhibit the relations between two arcs and their sum and difference, may be easily transformed into others which determine the relations between the sines, cosines, &c. of successive multiples of the same arc. If in the formulæ established in plane trigonometry (18) *et seq.* we substitute $n\omega$ for ω and ω for ω' we obtain the following results:

$$\text{sin.}(n \pm 1)\omega = \text{sin.}n\omega\ \text{cos.}\omega \pm \text{sin.}\omega\ \text{cos.}n\omega,$$
$$\text{cos.}(n \pm 1)\omega = \text{cos.}n\omega\ \text{cos.}\omega \mp \text{sin.}n\omega\ \text{sin.}\omega,$$
$$\text{sin.}(n+1)\omega + \text{sin.}(n-1)\omega = 2\text{sin.}n\omega\ \text{cos.}\omega,$$
$$\text{sin.}(n+1)\omega - \text{sin.}(n-1)\omega = 2\text{sin.}\omega\ \text{cos.}n\omega,$$
$$\text{cos.}(n+1)\omega + \text{cos.}(n-1)\omega = 2\text{cos.}n\omega\ \text{cos.}\omega,$$
$$\text{cos.}(n+1)\omega - \text{cos.}(n-1)\omega = -2\text{sin.}n\omega\ \text{sin.}\omega,$$
$$\text{sin.}(n+1)\omega\ \text{sin.}(n-1)\omega = \text{sin.}^2n\omega - \text{sin}^2\omega,$$
$$\text{cos}(n+1)\ \text{cos.}(n-1)\omega = \text{cos.}^2n\omega - \text{sin.}^2\omega,$$
$$\frac{\text{sin.}(n+1)\omega}{\text{sin.}(n-1)\omega} = \frac{\text{tan.}n\omega + \text{tan.}\omega}{\text{tan.}n\omega - \text{tan.}\omega},$$
$$\frac{\text{cos.}(n+1)\omega}{\text{cos.}(n-1)\omega} = \frac{1 - \text{tan.}n\omega\ \text{tan.}\omega}{1 + \text{tan.}n\omega\ \text{tan.}\omega},$$

The whole theory of angular sections, and all the various relations between the trigonometrical functions of an angle and its multiples, may be derived from two remarkable formulæ established by Euler, by which the sine and cosine of an angle are expressed as *exponential functions* of the angle itself. These formulæ we propose, in the first instance, to establish, and from them to derive all the theorems which form the subject of this part. They will thus hold the same relation to the analysis of angular sections as the formula for the sine of the sum of two angles does to plane trigonometry, and as the formulæ established in (25.) do to spherical trigonometry. Were it not that the principles upon which these exponential formulæ are established are not sufficiently elementary, the original formula for the sine of the sum of two angles itself might be deduced from them, and these celebrated theorems might thus be made the foundation of the whole superstructure of trigonometry.

The exponential formulæ for the sine and cosine which we are now to establish are

$$\text{sin.}x = \frac{1}{2\sqrt{-1}}\left(e^{x\sqrt{-1}} - e^{-x\sqrt{-1}}\right),$$

$$\text{cos.}x = \frac{1}{2}\left(e^{x\sqrt{-1}} + e^{-x\sqrt{-1}}\right).$$

Let

$$y = \text{sin.}x, \qquad z = \text{cos.}x,$$
$$\therefore dy = \text{cos.}x dx, \qquad dz = -\text{sin.}x dx,$$
$$\therefore dy = z dx, \qquad dz = -y dz\,;$$

multiplying the first by $\sqrt{-1}$, and adding the results, we obtain

$$dz + \sqrt{-1}dy = (z + \sqrt{-1}y)dx\sqrt{-1},$$
$$\therefore \frac{d(z+\sqrt{-1}y)}{z+\sqrt{-1}y} = \sqrt{-1}\,dx.$$

The first member of this equation is the differential of the hyperbolic logarithm of $z + \sqrt{-1}\,.y$, and $\therefore$

$$l(z + \sqrt{-1}y) = \sqrt{-1}\ .\ x,$$
$$\therefore \text{cos.}x + \sqrt{-1}\ .\ \text{sin.}x = e^{x\sqrt{-1}},$$

no constant is added, since both sides become equal when $x = 0$.

If the sign of x be changed, this becomes

$$\text{cos.}x - \sqrt{-1}\ \text{sin.}x = e^{-x\sqrt{-1}},$$

which being added to and subtracted from the former, gives

$$\left.\begin{aligned} \text{cos.}x &= \tfrac{1}{2}\left(e^{x\sqrt{-1}} + e^{-x\sqrt{-1}}\right) \\ \sqrt{-1}\ \text{sin.}x &= \tfrac{1}{2}\left(e^{x+x\sqrt{-1}} - e^{-x\sqrt{-1}}\right) \end{aligned}\right\}\ [1].$$

From these formulæ we can immediately deduce exponential values for tan.x. Dividing the second by the first, we find

$$\sqrt{-1}\ \text{tan.}x = \frac{e^{x\sqrt{-1}} - e^{-x\sqrt{-1}}}{e^{x\sqrt{-1}} + e^{-x\sqrt{-1}}} = \frac{e^{2x\sqrt{-1}} - 1}{e^{2x\sqrt{-1}} + 1}\ [3].$$

From the formulæ [1] another celebrated formula may be immediately derived, called from its discoverer, *Moivre's formula.* Since

$$\text{cos.}x + \sqrt{-1}\text{sin.}x = e^{x\sqrt{-1}},$$
$$(\text{cos.}x + \sqrt{-1}\text{sin.}x)^m = e^{mx\sqrt{-1}}.$$

But also,

$$\text{cos.}mx + \sqrt{-1}\text{sin.}mx = e^{mx\sqrt{-1}},$$
$$\therefore (\text{cos.}x + \sqrt{-1}\text{sin.}x)^m = \text{cos.}mx + \sqrt{-1}\text{sin.}mx\ [4].$$

By the principles which have just been established, we are enabled to resolve the formula

$$z^{2m} - 2az^m + 1$$

into its simple factors when a is not greater than unity.

Let $a = \text{cos.}x$, and the formula becomes

$$z^{2m} - 2\text{cos.}x\ .\ z^m + 1.$$

By solving the equation

$$z^{2m} - 2\text{cos.}xz'^m + 1 = 0,$$
$$z^m = \text{cos.}\ x \pm \sqrt{-1}\ \text{sin.}x,$$
$$\therefore z = (\text{cos.}x \pm \sqrt{-1}\ \text{sin.}x)^{\frac{1}{m}},$$
$$\therefore z = \text{cos.}\frac{x}{m} \pm \sqrt{-1}\ \text{sin.}\frac{x}{m}\cdot$$

Of these two formulæ for z', each is susceptible of m different values found by substituting successively for x,

$$x,\ 2\pi + x,\ 4\pi + x,\ \ldots\ 2(m-1)\pi + x,$$

and therefore the proposed formula resolved into its simple factors will be

$$z^{2m} - 2z^m \cos.x + 1 =$$

$$\left(z - (\cos.\frac{x}{m} + \sqrt{-1}\,\sin.\frac{x}{m})\right)$$

$$\left(z - (\cos.\frac{x}{m} - \sqrt{-1}\,\sin.\frac{x}{m})\right)$$

$$\left(z - (\cos.\frac{2\pi + x}{m} + \sqrt{-1}\,\sin.\frac{2\pi + x}{m})\right)$$

$$\left(z - (\cos.\frac{2\pi + x}{m} - \sqrt{-1}\,\sin.\frac{2\pi + x}{m})\right)$$

$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$

$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$

$$\left(z - (\cos.\frac{2(m-1)\pi + x}{m} + \sqrt{-1}\,\sin.\frac{2(m-1)\pi + x}{m})\right)$$

$$\left(z - (\cos.\frac{2(m-1)\pi + x}{m} - \sqrt{-1}\,\sin.\frac{2(m-1)\pi + x}{m}\right)$$

If each pair of simple factors be united by multiplication, we shall have the proposed formula resolved into real quadratic factors,

$$z^{2m} - 2z^m \cos.x + 1 =$$

$$(z^2 - 2z\cos.\frac{x}{m} + 1)(z^2 - 2z\cos.\frac{2\pi + x}{m} + 1)$$

$$\times(z^2 - 2z\cos.\frac{4\pi + x}{m} + 1)(z^2 - 2z\cos.\frac{6\pi + x}{m} + 1)$$

$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$

$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$

$$\times(z^2 - 2z\cos.\frac{2(m-1)\pi + x}{m} + 1).$$

It appears, therefore, that in general all the simple factors are imaginary, and the quadratic real. This theorem was discovered by *Moivre*, and previously another similar to it, and deducible from it, was discovered by *Cotes*. In the last, let $x = 0$, and we have

$$z^{2m} - 2z^m + 1 = (z^2 - 2z + 1)\times(z2 - 2z\cos.\frac{2\pi}{m} + 1)$$

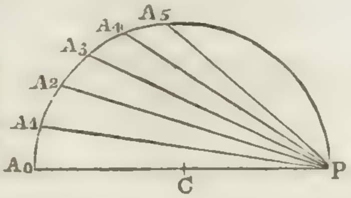
$$\times(z^2 - 2z\cos.\frac{4\pi}{m} + 1)$$

$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$

$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$

$$\times(z^2 - 2z\cos.\frac{2(m-1)\pi}{m} + 1).$$

The principles which have been established in this section supply a very elegant geometrical construction, representing the sums of the squares, cubes, &c. of the roots of a quadratic equation of the form $z^2 - pz + 1 = 0$, in which p is not > 2.



Let a circle be described with a radius equal to unity, and let $A_0PA_1 = x$, and let the arcs A_0A_1, A_1A_2, A_2A_3, ... be equal.

It is obvious that

$$PA_1 = 2\cos.x,\ PA_2 = 2\cos.2x,\ PA_3 = 2\cos.3x,\ \&c.$$

Let x be assumed, so that $PA_1 = p$, which is always possible, since p is not > 2. Hence

$$z^2 - 2z\cos.x + 1 = 0,$$

$$\therefore z + \frac{1}{z} = 2\cos.x = PA_1,$$

and by what has been already proved, it follows that

$$z^2 + \frac{1}{z^3} = 2\cos.2x = PA_2.$$

SECTION II.

Of the Development of Sines and Cosines, of Multiple Arcs in Powers of the Sines and Cosines of the Simple Arcs.

The developments respecting multiple arcs may be divided into two distinct classes. The first includes all series in which the sine or cosine of a multiple arc is expressed in powers of those of the simple arc, and the second those in which a power of the sine or cosine of a simple arc is expressed in a series of sines or cosines of its multiples; to the former we shall devote the present section, reserving the latter for the following one.

The series in powers of the sine, cosine, &c. may be either ascending or descending, and accordingly the several problems into which our analysis resolves itself may be enumerated as follow:

$$\text{To develope, } 1^\circ.\ \left.\begin{array}{r}\cos mx\\ \sin.mx\end{array}\right\}\begin{array}{c}\text{in ascending powers of}\\ \cos.x.\end{array}$$

$$2^\circ.\ \left.\begin{array}{r}\sin.mx\\ \cos.mx\end{array}\right\}\begin{array}{c}\text{in ascending powers of}\\ \sin.x.\end{array}$$

$$3^\circ.\ \left.\begin{array}{r}\sin.mx\\ \cos.mx\end{array}\right\}\begin{array}{c}\text{in ascending powers of}\\ \tan.x.\end{array}$$

$$4^\circ.\ \left.\begin{array}{r}\cos.mx\\ \sin.mx\end{array}\right\}\begin{array}{c}\text{in descending powers of}\\ \cos.x.\end{array}$$

$$5^\circ.\ \left.\begin{array}{r}\sin.mx\\ \cos.mx\end{array}\right\}\begin{array}{c}\text{in descending powers of}\\ \sin.x.\end{array}$$

*To develope cos.*mx *in a series of ascending powers of cos.*x.

Let $\cos x = y$, and let

$$z = y + \sqrt{y^2 - 1},$$

$$\therefore \frac{1}{z} = y - \sqrt{y^3 - 1},$$

But

$$2\cos.mx = z^m + \frac{1}{2^m}.$$

If then z^m be obtained in ascending powers of y and z^{-m} deduced from it by changing the sign of m, we shall thence obtain $2\cos.mx$ in a series of the required form.

Let

$$z^m = u = A_0 + A\,y + A_2y^2 + A_3y^3 + \ .\ .\ .\ .$$

The solution of the question will be effected if the values of the coefficients of this series can be obtained without introducing any condition which restricts the generality of the problem.

Let the series assumed to express u be twice differentiated, and the results will be

$$\frac{du}{dy} = A_1 + 2A_2 y + 3A_3 y^2 + 4A_4 y^3 + \ldots .$$

$$\frac{d^2u}{dy^2} = 2A_2 + 2.3A_3 y + 3.4A_4 y^2 + \ldots .$$

Also, let

$$u = (y + \sqrt{y^2 - 1})^m$$

be twice successively differentiated, and the results are

$$\left(\frac{du}{dy}\right)^2 (y^2 - 1) - m^2 u = 0,$$

$$\left(\frac{du}{dy}\right)\left(\frac{d^2u}{dy^2}\right)(y^2 - 1) + \left(\frac{du}{dy}\right)^2 y - \left(\frac{du}{dy}\right) m^2 u = 0,$$

which divided by $\frac{du}{dy}$, gives

$$\frac{d^2u}{dy^2}(y^2 - 1) + \left(\frac{du}{dy}\right) y - m^2 u = 0.$$

Let the values of u, $\frac{du}{dy}$, $\frac{d^2u}{dy^2}$, derived from differentiating the assumed series, be substituted in the last equation, and let the result be arranged according to the ascending powers of y. We shall thus obtain the following series:

$$\begin{aligned} & A_0 m^2 + 2A_2, \\ & + [A_1(m^2 - 1) + 2.3A_3]y, \\ & + [A_2(m^2 - 4) + 3.4A_4]y^2, \\ & + [A_3(m^2 - 9) + 4.5A_5]y^3, \\ & + [A_4(m^2 - 16) + 5.6A^5]y^4. \\ & \ldots \ldots \ldots \\ & \ldots \ldots \ldots \\ & + \{A_{n-2}[m^2 - (n-2)^2] + (n-1)(n)A_n\} y^{n-2}, \\ & \ldots \ldots \ldots \\ & \ldots \ldots \ldots = 0. \end{aligned}$$

Since this must be fulfilled independently of y, the coefficients must severally $= 0$. Hence we find

$$A_2 = -\frac{m^2}{2}A_0, \qquad A_3 = -\frac{m^2-1}{2.3}A_1,$$

$$A_4 = -\frac{m^2-4}{3.4}A_2, \qquad A_5 = -\frac{m^2-9}{4.5}A_3,$$

$$\ldots \ldots \ldots$$

$$A_n = -\frac{m^2-(n-2)^2}{(n-1)n}A_{n-2},$$

$$. = \ldots \ldots$$

Hence we obtain the following conditions:

$$A_2 = -\frac{m^2}{2}A_0, \qquad A_3 = -\frac{m^2-1}{2.3}A_1,$$

$$A_4 = +\frac{m^2(m^2-4)}{2.3.4}A_0,$$

$$A_5 = +\frac{(m^2-1)(m^2-9)}{2.3.4.5}A_1,$$

$$A_6 = -\frac{m^2(m^2-4)(m^2-16)}{2.3.4.5.6.}A_0,$$

$$\ldots \ldots \ldots$$

$$\ldots \ldots \ldots$$

The law of which is evident. These conditions, however, fail to determine the first two coefficients A_0, A_1. To find these, let $y = 0$ in the series for u and $\frac{du}{dy}$, and also in the values

$$u = z^m = (y + \sqrt{y^2 - 1})^m,$$

$$\frac{du}{dy} = \frac{mu}{\sqrt{y^2-1}}:$$

and equating the results, we obtain

$$A_0 = (\sqrt{-1})^m = (-1)^{\frac{m}{2}},$$

$$A_1 = m(\sqrt{-1})^{m-1} = m(-1)^{\frac{m-1}{2}},$$

whence we find

$$A_2 = -\frac{m^2}{2}(-1)^{\frac{m}{2}}.$$

$$A_3 = -\frac{m^2-1^2}{2.3}.\, m(-1)^{\frac{m-1}{2}},$$

$$A_4 = +\frac{m^2(m^2-2^2)}{2.3.4}(-1)^{\frac{m}{2}},$$

$$A_5 = +\frac{(m^2-1^2)(m^2-3^2)}{2.3.4.5}.\, m(-1)^{\frac{m-1}{2}},$$

$$A_6 = -\frac{m^2(m^2-2^2)(m^2-4^2)}{2.3.4.5.6}(-1)^{\frac{m}{2}}$$

$$. = - \ldots \ldots \ldots$$

$$. = + \ldots \ldots \ldots$$

Hence we find

$$z^m = (-1)^{\frac{m}{2}} \left\{ 1 - \frac{m^2}{1.2}y^2 + \frac{m^2(m^2-2^2)}{1.2.3.4}y^4 - \frac{m^2(m^2-2^2)(m^2-\ }{1.2.3.4.5.6} \right.$$

$$+ \frac{m^2(m^2-2^2)(m^2-4^2)(m^2-6^2)}{1.2.3.4.5.6.7.8}y^8 - \ldots .$$

$$+ m(-1)^{\frac{m-1}{2}} \left\{ y - \frac{(m^2-1^2)}{1.2.3}y^3 + \frac{(m^2-1^2)(m^2-3^2)}{1.2.3.4.5}y^5 \right.$$

$$- \frac{(m^2-1^2)(m^2-3^2)(m^2-5^2)}{1.2.3.4.5.6.7}y^7 + \ldots .$$

To find the series for z^{-m}, it is only necessary to change the sign of m in the result which has just been obtained. Since neither of the series in this result contains any odd power of m, this change produces no other effect than to change the sign of the coefficient of the second parenthesis. Let the series in the first parenthesis be called for brevity S, and that in the second S′, and we have

$$z^m = (-1)^{\frac{m}{2}}.\, S + m(-1)^{\frac{m-1}{2}}.\, S',$$

$$z^{-m} = (-1)^{\frac{-m}{2}}.\, S + m(-1)^{\frac{-m-1}{2}}.\, S';$$

since $-m(-1)^{\frac{-m-1}{2}} = m(-1)^{\frac{-m-1}{2}}$.

Hence, by addition we obtain,

$$z^m + z^{-m} = [(-1)^{\frac{m}{2}} + (-1)^{\frac{-m}{2}}]S + [(-1)^{\frac{m-1}{2}} + (-1)^{\frac{-m-1}{2}}]$$

$$\therefore 2\cos. mx = [(-1)^{\frac{m}{2}} + (-1)^{\frac{-m}{2}}]S + [(-1)^{\frac{m-1}{2}}$$

$$+ (-1)^{\frac{-m-1}{2}}]mS' \ldots . [$$

which is the development sought.

ne form of the coefficients of this formula may be changed. have

$$s.x+\sqrt{-1}\,\sin.x)^m=\cos.m(2n\pi\pm x)+\sqrt{-1}\,\sin.m(2n\pi\pm x),$$

ng any positive integer. Let $x=\frac{1}{2}\pi$, ∴

$$-1)^{\frac{m}{2}}=\cos.\tfrac{1}{2}m(4n\pm 1)\pi+\sqrt{-1}\,\sin.\tfrac{1}{2}m(4n\pm 1)\pi,$$

$$\sqrt{-1})^{-m}=\cos.\tfrac{1}{2}m(4n\pm 1)\pi-\sqrt{-1}\,\sin.\tfrac{1}{2}m(4n\pm 1)\pi,$$

$$-1)^{\frac{m}{2}}+(-1)^{-\frac{m}{2}}=2\cos.\tfrac{1}{2}m(4n\pm 1)\pi,$$

$$-1)^{\frac{m-1}{2}}+(-1)^{\frac{-m-1}{2}}=2\cos.\tfrac{1}{2}(m-1)(4n\pm 1)\pi.$$

ence the series for cos.mx becomes

$$nx=\cos.\tfrac{1}{2}m(4n\pm 1)\pi.\mathrm{S}+\cos.\tfrac{1}{2}(m-1)(4n\pm 1)\pi.\mathrm{mS}'\ldots[2].$$

In this formula n is an indeterminate integer for each value of which the second member has two values corresponding to the double sign $\pm$. The successive terms of the series

$$0,\ 1,\ 2,\ 3,\ \ldots\ .$$

being substituted for n in $\cos.\frac{1}{2}m(4n+1)\pi$, it will successively assume different values until the number substituted for n is equal to the denominator of m; for this value of n the value of $\cos.\frac{1}{2}m(4n+1)\pi$ will be equal to that obtained by substituting 0 for n; and all integers greater than the denominator of m will in like manner give a constant repetition of values before obtained by substituting for n values less than the denominator of m. It follows, therefore, that $\cos.\frac{1}{2}m(n+1\pi)$ is in general susceptible of as many different values as there are units in the denominator of m, and no more. In like manner $\cos.\frac{1}{2}m(4n-1)\pi$ is susceptible of the same number of values, and therefore the coefficient of S is susceptible of twice as many values as there are units in the denominator of m, and a like observation applies to the coefficient of $m\mathrm{S}'$.

Since S and S′ involve no functions of x except cos.x, the change of x into $2n\pi\pm x$ makes no change in their value, and it follows, therefore, that for a given value of cos.x the second member of [2] is susceptible of twice as many values as there are units in the denominator of m. It is therefore necessary to show how cos.mx can have several corresponding values to a given value of cos.x. The angle x being changed into $2n'\pi\pm x$, n' being an integer, makes no change in cos.x, but changes cos.mx into $\cos.m(2n'\pi\pm x)$, which has twice as many values as there are units in the denominator of m. Hence the formula [2] will be more generally and correctly expressed thus,

$$\cos.m(2n'\pi\pm x)=\cos.\tfrac{1}{2}m(4n\mp 1\pi)\,.\,\mathrm{S}.$$
$$+\cos.\tfrac{1}{2}(m-1)(4n\pm 1)\pi\,.\,m\mathrm{S}',$$

where both members have the same number of values, and where the values of the indeterminate integers, n', n are supposed to be less than the denominator of m.

It still remains, however, to show the values of each member which correspond respectively to those of the other. Since the value of each member changes by ascribing different values to the integers n' and n, this question only amounts to the determination of the relation between any two corresponding values of these integers.

Let $x=\frac{1}{2}\pi$, and therefore $\mathrm{S}=1$, $\mathrm{S}'=0$. Hence

$$\cos.m(2n'\pi+\tfrac{1}{2}\pi)=\cos.\tfrac{1}{2}m(4n\pm 1)\pi,$$
$$\text{or }\cos.\tfrac{1}{2}m(4n'\pm 1)\pi=\cos.\tfrac{1}{2}m(4n\pm 1)\pi,$$

Since n and n' are not supposed to receive any value greater than the denominator of m (for all the values of the cosine after that would only be repetitions of former values), this last condition can only be satisfied by

$$n=n'.$$

Hence the formula becomes[*]

$$\cos.m(2n\pi\pm x)=\cos.\tfrac{1}{2}m(4n+1)\pi\,.\,\mathrm{S}$$
$$+\cos.\tfrac{1}{2}(m-1)(4n\pm 1)\pi\,.\,m\mathrm{S}'\quad.\quad.\quad[3]\cdot$$

*To develope sin.*mx *in ascending powers of cos.*x.

By subtracting the value of z^{-m} from that of z^m, the result being disengaged from the imaginary symbols becomes

$$\sin.m(2n\pi\pm x)=\sin.\tfrac{1}{2}m(4n\pm 1)\pi\mathrm{S}+\sin.\tfrac{1}{2}(m-1)$$
$$(4n\pm 1)\pi.\,m\mathrm{S}'.\quad[4].$$

All the observations in the last proposition are equally applicable here. When the denominator of m is an odd integer there are always two values of an angle x whose cosine is given, which are such that sin.mx will be expressed by only one of the two series in [4].

Another form for the development of sin.mx in ascending powers of the cos.x may be established by differentiating the series found for cos.mx. By this process we obtain

$$m\sin.m(2n\pi\pm x)=-\cos.\tfrac{1}{2}m(4n\pm 1)\pi.\frac{d\mathrm{S}}{dx}$$
$$-\cos.\tfrac{1}{2}(m-1)(4n\pm 1)\pi\,.\,m\frac{d\mathrm{S}'}{dx},$$

---

[*] In clearing the formula [1] of imaginary quantities, *Lagrange* has fallen into an error which was lately detected by *Poinsot*, and the difficulty explained as above. *Lagrange's* mistake arose from assuming that

$$(\sqrt{-1})m)=\cos.\tfrac{1}{2}m\pi+\sqrt{-1}\,\sin.\tfrac{1}{2}m\pi,$$

which is evidently erroneous, since the first member has as many different values as there are units in the denominator of m, and the second member has but one value. He forgot to take into account, that while the change of x into $2n\pi+x$ produces no change on

$$(\cos.x+\sqrt{-1}\,\sin.x)^m,$$

it does produce a change on

$$\cos.mx+\sqrt{-1}\,\sin.mx.$$

In fact, without this consideration, *Moivre's formula* itself is involved in the absurdity of one member having a greater number of different values than the other.

$$\frac{dS}{dy} = -\frac{m^2}{1}y + \frac{m^2(m^2-2^2)}{1.2.3}y^3 - \frac{m^2(m^2-2^2)(m^2-4^2)}{1.2.3.4.5}y^5 + \ldots = -m\mathrm{R},$$

$$\frac{dS'}{dy} = 1 - \frac{m^2-1^2}{1.2}y^2 + \frac{(m^2-1^2)(m^2-3^2)}{1.2.3.4}y^4 - \ldots = \mathrm{R}'$$

$$\frac{dy}{dx} = -\sin.x,$$

$$\therefore \frac{dS}{dx} = m\sin.x\mathrm{R},\ \frac{dS'}{dx} = -\sin.x.\mathrm{R},$$

$$\therefore m\sin.m(2n\pi \pm x) = -\sin.x[\cos.\tfrac{1}{2}m(4n\pm 1)\pi.m.\mathrm{R} - \cos.\tfrac{1}{2}(m-1)(4n\pm 1)\pi.\mathrm{R}'] \ldots \quad [5].$$

This being deduced directly from the formula [3] is liable to the various modifications which have been shown to be incident to [3], on assigning particular values to m and n.

To develope the cosine or sine of a multiple arc in ascending powers of the sine of the simple arc.

Let $y = \sin.x$

$$z = \sqrt{1-y^2} + y\sqrt{-1},$$

$$z^m = (\sqrt{1-y^2} + y\sqrt{-1},)^m;$$

and since

$$2\cos.mx = z^m + z^{-m},$$

$$2\sqrt{-1}\sin.mx. = z^m - z^{-m},$$

the problem will be solved by obtaining the development of z^m in ascending powers of y.

Let

$$z^m = \mathrm{A}_0 + \mathrm{A}_1 y + \mathrm{A}_2 y^2 + \ldots$$

By proceeding exactly as in the former case we shall obtain

$$z^m = \mathrm{A}_0\left\{1 - \frac{m^2}{1.2}y^2 + \frac{m^2(m^2-2^2)}{1.2.3.4}y^4 \frac{m^2(m^2-2^2)(m^2-4^2)}{1.2.3.4.5.6}y^6 + \ldots\right\}$$

$$+ \mathrm{A}\left\{y - \frac{m^2-1^2}{1.2.3}y^3 + \frac{(m^2-1^2)(m^2-3^2)}{1.2.3.4.5}y^5 - \ldots\right\}.$$

The values of A_0 and A_1 may be determined by making $y = 0$ in the two values of z^m and $\frac{d(z^m)}{dy}$, and equating the results, which gives*

$$\mathrm{A}_0 = (1)^{\frac{m}{2}},\ \mathrm{A}_1 = m\sqrt{-1}(1)^{\frac{m-1}{2}}.$$

The value of z^{-m} may be deduced from that of z^m by changing the sign of m. Hence, if the series which enter these values be Q, Q′, we obtain

$$z^m = (1)^{\frac{m}{2}}\mathrm{Q} + \sqrt{-1}(1)^{\frac{m-1}{2}}m\mathrm{Q}',$$

$$z^{-m} = (1)^{\frac{m}{2}}\mathrm{Q} - \sqrt{-1}\,(1) - \frac{m-1}{2}m\mathrm{Q}',$$

$$\therefore 2\cos.mx = [(1)^{\frac{m}{2}} + (1)^{\frac{m}{2}}]\mathrm{Q} + \sqrt{-1}\,(1)^{\frac{m-1}{2}} + (1)^{\frac{-m-1}{2}}]m\mathrm{Q}',$$

$$2\sqrt{-1}\sin.mx = [(1)^{\frac{m}{2}} - (1)^{\frac{-m}{2}}]\mathrm{Q} + \sqrt{-1}[(1)^{\frac{m-1}{2}} + (1)^{\frac{m-1}{2}}m\mathrm{Q}.$$

It will be observed, that by changing x into $2n\pi + x$, no change is made on the series Q and Q′; but there is a change made upon the first member of each equation. The coefficients of Q and Q′ have exactly as many different values as the first members of the equation. This is a circumstance which has been hitherto overlooked.†

The above formulæ can be cleared of imaginary quantities by the usual method,

$$(1)^{\frac{m}{2}} = \cos.nm\pi + \sqrt{-1}\sin.nm\pi,$$

$$(1)^{\frac{m-1}{2}} = \cos.n(m-1)\pi + \sqrt{-1}\sin.n(m-1)\pi,$$

the number n being an indeterminate integer. All the arcs which have the same sine may be included under the formula $n\pi \pm x$, x being taken with the sign + when n is even, and — when n is odd. Hence the formulæ become

$$\cos.m(n\pi \pm x) = \cos.nm\pi.\mathrm{Q} - \sin.n(m-1)\pi.m\mathrm{Q}'.[6.]$$

$$\sin.m(n\pi \pm x) = \sin.nm\pi.\mathrm{Q} + \cos.n(m-1)\pi.m\mathrm{Q}'.[7.]$$

To develope the sine and cosine of a multiple arc in a series of ascending powers of the tangent of the simple arc.

By developing the formula

$$\cos.mx + \sqrt{-1}\sin.mx = (\cos.x + \sqrt{-1}\sin.x)^m;$$

by the binominal theorem we shall obtain

$$\cos.mx + \sqrt{-1}\sin.mx = \mathrm{R} + \sqrt{-1}\,\mathrm{R}'.\ [8.]$$

where R represents the sum of the odd, and R′ of the even terms of the development, and therefore

$$\mathrm{R} = \cos.^m x - \mathrm{A}_2\cos.^{m-2}x\sin.^2 x + \mathrm{A}_4\cos.^{m-4}x\sin.^4 x - \ldots$$

$$\mathrm{R}' = \mathrm{A}_1\cos.^{m-1}x\sin.x - \mathrm{A}_3\cos.^{m-3}x\sin.^3 x + \mathrm{A}_5\cos.^{m-5}x\sin.^5$$

where $\mathrm{A}_1, \mathrm{A}_2, \mathrm{A}_3, \ldots$ represent the coefficients of the second and succeeding terms of the expanded binomial, whose exponent is m.

As each side of the equation [8] consists partly of real and partly of imaginary quantities, it is equivalent to two distinct equations, between each separately. If we consider R composed exclusively of real, and $\sqrt{-1}\mathrm{R}'$ of imaginary quantities, we should therefore have

$$\left.\begin{aligned}\cos.mx &= \mathrm{R}\\ \sin.mx &= \mathrm{R}'\end{aligned}\right\}[9.]$$

These formulæ, which were first published by *John Bernoulli* in the Leipsic Acts, 1701, have been, even to the present day, considered as exact and general. This, however, is not the case.

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* Lagrange, and all the mathematicians after him, have fallen into an error in the determination of these coefficients. *Poinsot* has lately corrected it.

† *Poinsot*, 1825.

To explain this, let

$$T = 1 - A_2 \tan.^2 x + A_4 \tan.^4 x - \ldots$$
$$T' = A_1 \tan. x - A_3 \tan.^3 x + A_5 \tan.^5 x - \ldots$$
$$\therefore R = \cos.^m x . T,$$
$$R' = \cos.^m x T'.$$

By changing x into $2n\pi + x$, the factors T, T′, of the second members of

$$\cos. mx = \cos.^m x . T,$$
$$\sin. mx = \cos.^m x . T',$$

undergo no change, since these arcs have the same tangent, and since T, T′, include no powers except integral powers of $\tan. x$, they can have each but one value for an arc, whose sine and cosine are given. The first factor $\cos.^m x$ has, however, as many different values as there are units in the denominator of m, of which two, at most, can be real, and all the others must be imaginary. On the other hand, for an arc whose sine and cosine are given, and which is of the form $2n\pi + x$, n being any integer, the first members of these equations have as many different values as there are units in the denominator of m, and *all* these values are *real*. Thus the two members of the equations are inconsistent.

It is not difficult to perceive that this absurdity has arisen from the false assumption that the real and imaginary parts of the second member of [8] were R and $\sqrt{-1} R'$. We shall find upon consideration that neither of these quantities are altogether real, or altogether imaginary, but that each of them is composed partly of real and partly of imaginary quantities, and is of the form $a + \sqrt{-1}.b$.

In the formula

$$\cos. mx + \sqrt{-1} \sin. mx = \cos.^m x (T + \sqrt{-1} T'),$$

let the absolute, real, or arithmetical value of $\cos.^m x$, ($\cos. x$ being considered merely as a number,) be P. It is plain that its several algebraical values will be expressed by the formula $P(\pm 1)^m$. And since

$$(\pm 1)^m = \cos. mn\pi + \sqrt{-1} \sin. mn\pi,$$
$$\therefore \cos.^m x = P(\cos. mn\pi + \sqrt{-1} \sin. mn\pi),$$

the indeterminate integer n being even when $\cos. x$ is positive, and odd when it is negative.

Making this substitution in the former equation, and in place of x, substituting the general formula $n'\pi \pm x$ for all arcs having the same cosine, in which the sign + is used when n' is even, and − when it is odd, we obtain

$$\cos. m(n'\pi \pm x) + \sqrt{-1} \sin. m(n'\pi \pm x)$$
$$= P(T \cos. mn\pi - T' \sin. mn\pi)$$
$$+ \sqrt{-1}. P(T \sin. mn\pi + T' \cos. mn\pi).$$

Here the real and imaginary parts are separated on each side, and equating them, we have

$$\cos. m(n'\pi \pm x) = P(T \cos. mn\pi - T' \sin. mn\pi),$$
$$\sin. m(n'\pi \pm x) = P(T \sin. mn\pi + T' \cos. mn\pi).$$

Each member of these equations is susceptible of as many different values as there are units in the denominator of m. But it remains still to be determined which of the values of the second members correspond or are equal to those of the first severally. In other words, it is necessary to determine what relation subsists between the indeterminate integers n' and n, neither of which are supposed to exceed twice the denominator of m. To determine this, let $x = 0$, $\therefore P = 1$, $T = 1$, $T' = 0$. Hence

$$\cos. mn'\pi = \cos. mn\pi,$$
$$\sin. mn'\pi = \sin. mn\pi,$$
$$\therefore n' = n.$$

These integers are therefore always equal, and the formulæ become

$$\cos. m(n\pi \pm x) = P(T \cos. mn\pi - T' \sin. mn\pi) \ldots [10].$$
$$\sin. m(n\pi \pm x) = P(T \sin. mn\pi + T' \cos. mn\pi) \ldots [11].$$

Whether the odd or even integers are to be substituted for n in these formulæ, and whether x is to be taken with + or −, is to be determined by the signs of $\sin. x$ and $\cos. x$, which are supposed to be given. If $\cos. x$ be positive, the values of n are to be selected from the series

$$0, 2, 4, 6, \ldots;$$

if it be negative, they are to be selected from

$$1, 3, 5, \ldots.$$

If $\sin. x$ be positive, x is to be taken with +, and if negative, with −. In all cases, however, the coefficient P in the second members is to be considered as an abstract number independent of any sign.

If m be an integer, the formulæ are reduced to the forms

$$\cos. mx = \cos.^m x T, \quad \sin. mx = \cos.^m x T',$$

which have hitherto been taken to be general for all values of m.

To develope the cosine or sine of a multiple arc in descending powers of the cosine of the simple arc.

This problem was investigated by *Euler*, and subsequently by *Lagrange*, and both obtained the same result although they proceeded on different principles and by different methods. The series which were the results of their investigations, and which have, even to the present time, been received as general and exact, are the following,

$$2\cos. mx = (2y)^m - m(2y)^{m-2} + \frac{m(m-3)}{1.2}(2y)^{m-4}$$
$$- \frac{m(m-4)(m-5)}{1.2.3}(2y)^{m-6} + \frac{m(m-5)(m-6)(m-7)}{1.2.3.4}(2y)^{m-8}$$
$$- \ldots\ldots + \ldots\ldots$$
$$+ (2y)^{-m} + m(2y)^{-m-2} + \frac{m.m+3}{1.2}(2y)^{-m-4},$$
$$+ \frac{m(m+4)(m+5)}{1.2.3}(2y)^{-m-6} + \frac{m(m+5)(m+6)(m+7)}{1.2.3.4}(2y)^{-m-8}$$
$$+ \ldots\ldots + \ldots\ldots$$
$$\ldots\ldots [12].$$

where $y=\cos.x$. The series for $\sin.mx$ was deduced from this by differentiation.

Poinsot has examined the analysis by which these results were obtained, and shown that it is fallacious, and that the results themselves are false. To render this refutation intelligible, it would be necessary to detail the process by which *Euler* and *Lagrange* established the formulæ, which would lead to investigations unsuited to the purposes of the present treatise. As, however, the results of *Lagrange* have been hitherto universally received as correct, it is proper to make the reader aware of the fact of their having been proved erroneous.

We shall confine ourselves here to the investigation of the true development of $\cos.mx$ and $\sin.mx$.

Let $p=\cos.x$ and $q=\sin.x$ We have then

$$\cos.mx=p^m\left(1-A_2\frac{q^2}{p^2}+A_4\frac{q^4}{p^4}-A_6\frac{q^6}{p^6}+\ \ldots\ldots\right)$$

where $1, A_1, A_2, \ldots\ldots$ are the coefficients of the binomial series, m being the exponent. We have

$$q^2=1-p^2,\ q^4=1-2p^2+p^4,\ \ldots\ldots$$

Let these values be substituted for q^2, q^4, &c. and let the results be arranged according to the descending powers of p, and we have

$$\cos.mx=Ap^m-Bp^{m-2}+\frac{1}{2}Cp^{m-4}-\frac{1}{1.2.3}Dp^{m-6}+\&c.$$

where

$$A=1+A_2+A_4+A_6\ \ldots\ldots$$
$$B=A_2+2A_4+3A_6+4A_8+5A_{10}\ \ldots\ldots$$
$$\tfrac{1}{2}C=A_4+3A_6+6A_8+10A_{10}+\ \ldots\ldots$$
$$\frac{1}{1.2.3}D=A_6+4A_8+10A_{10}+20A_{12}$$
$$.\ \ .\ =\ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .$$
$$.\ \ .\ =\ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .$$

The law by which these coefficients are formed is evident, but it is necessary to obtain finite expressions for them as functions of m. For this purpose, let us suppose that the successive terms of the first coefficient A were multiplied by the successive powers of an arbitrary quantity y, so that it becomes

$$1+A_2y+A_4y^2+A_6y^3+\ \ldots\ldots$$
$$\text{or } 1+\frac{m(m-1)}{1.2}y+\frac{m(m-1)(m-2)(m-3)}{1.2.3.4}y^2+\ldots\ldots$$

But this last is equivalent to

$$\frac{(1+\sqrt{y})^m+(1-\sqrt{y})^m}{2}=U;$$

so that U becomes equal to A when $y=1$. It is not difficult to perceive that the other coefficients are what the successive differential coefficients of U taken with respect to y as a variable become when $y=1$. We have

$$U=1+A_2y+A_4y^2+A_6y^3+\ \ldots\ldots$$
$$\frac{dU}{dy}=A_2+2A_4y+3A_6y^2+4A_8y^3\ \ldots\ldots$$
$$\frac{1}{2}\,\frac{d^2U}{dy^2}=A_4+3A_6y+6A_8y^2+\ \ldots\ldots$$
$$.\ \ .\ =\ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ ;$$
$$.\ \ .\ =\ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .$$

When $y=1$, the second members of these equations become equal severally to A, B, $\tfrac{1}{2}$C, $\frac{1}{1.2.3}$. D..... Let the values of the function U and its successive differential coefficients when $y=1$ be called Y, Y′, Y″, Y‴, &c; we have hence

$$A=Y=\frac{1}{2}\left\{\ 2^m+0^m\ \right\}$$
$$B=Y'=\frac{1}{2^2}\left\{m(2^{m-1}-0^{m-1})\right\},$$
$$C=Y''=\frac{1}{2^3}\left\{m(m-1)(2^{m-2}+0^{m-2})-m(2^{m-1}-0^{m-1})\right\}$$
$$D=Y'''=\frac{1}{2^4}\left\{m(m-1)(m-2)(2^{m-3}-0^{m-3})\right.$$
$$\left.-3m(m-1)(2^{m-2}+0^{m-2})+3m(2^{m-1}-0^{m-1})\right\};$$
$$E=Y''''=\frac{1}{2^5}\left\{m(m-1)(m-2)(m-3)(2^{m-4}+0^{m-4})\right.$$
$$-6m(m-1)(m-2)(2^{m-3}-0^{m-3})+15m(m-1)(2^{m-2}+0^{m-2})$$
$$\left.-15m(2^{m-1}-0^{m-1})\ \right\},\ \&c.\ \&c.$$

In these analytical expressions for the coefficients of the sought series, it is necessary to preserve the terms 0^m, 0^{m-1}, 0^{m-2}, &c. because each of these powers of 0 become either unity, 0, or infinite, according as the exponent of the power is $=0$, positive or negative.

The true development, therefore, of $\cos.mx$ in descending powers of $\cos.x$ or p, the angle x being supposed less than a right angle, and only considering a single value of $\cos.mx$ relative to the arc x, is

$$\cos.mx=Yp^m-Y'p^{m-2}+\tfrac{1}{2}Y''p^{m-4}-\frac{1}{2.3}Y'''p^{m-6}+\ldots\ldots$$

If m be a positive integer, this series will be finite, since all the terms beyond a certain term will $=0$, and it will thus give the exact value of $\cos.mx$. Thus when $m=0$, or $m=1$, we find that the first coefficient only has a finite value, and all the others $=0$. For $m=2$ and $m=3$, the first two coefficients are finite, and all the rest $=0$. For $m=4$, $m=5$, there are three terms finite, and all the rest equal nothing; and in general, if m be an even integer, the number of finite terms is $\frac{m}{2}+1$, and if it be odd, $\frac{m+1}{2}$.

But if m be a fraction, the series never terminates, and the coefficients only continue finite as long as the exponent of 0 which occurs in them is not negative. After this happens, all the succeeding coefficients are infinite. Thus, if m be a fraction between 0 and 1 the first coefficient alone is finite, and all the rest infinite. If m be between 1 and 2, the first two coefficients are finite, and all the rest infinite, and so on. If m be a fraction between $n-1$ and n, the first n terms are finite and all the rest infinite. The series, therefore, in these cases is useless and absurd, and the same happens when m is negative. From whence we may conclude, that the development of the cosine of a multiple arc in descending powers of that of the simple arc is never possible, except when the coefficient of the multiple is a positive integer; and in this case, since the number of terms is finite, the series is nothing more than the series already obtained in ascending powers, the order of the terms being reversed. So that, in effect, the only case in which the development by descending powers is possible, it is useless.

It is worthy of remark, that in the analytical expression for the coefficients A, B, $\frac{1}{2}$C, &c. if the powers 0^m, 0^{m-1}, 0^{m-2}, &c. be neglected, the coefficients will be exactly those of the series [12], which has been hitherto considered exact.—Whence may be seen the reason why this series gives false values for cos.mx, and also why in the particular case in which m is an integer the value resulting from it will be exact if we retain in it only the positive powers of p, for that is in effect rejecting all that part of the true development which becomes $=0$.

*To develope sin.*mx *in descending powers of cos.*x.

To effect this, it is only necessary to differentiate the series [12]. This being done, and the result divided by $2m$, and observing that $dy = d\cos.x = -\sin.x dx$, we obtain

$$\frac{\text{n.}mx}{\sin.x} = (2y)^{m-1} - (m-2)(2y)^{m-3} + \frac{(m-3)(m-4)}{1.2}(2y)^{m-5}$$

This development, like the last, is only possible when m is an integer.

To develope the cosine and sine of a multiple arc in descending powers of the sign of the simple arc.

In [12] and [13] let x be changed into $\frac{\pi}{2} - x$, and the two series being expressed by M and M′, and p being understood to express sin.x, instead of cos.x, we shall have

$$2\cos.m\left(\frac{\pi}{2} - x\right) = \text{M},$$

$$\sin.m\left(\frac{\pi}{2} - x\right) = \cos.x\text{M}'.$$

In this case, as in the former, m must be an integer.

SECTION III.

Of the Development of a Power of the Sine or Cosine of an Arc in a series of Sines or Cosines of its Multiples.

To develope cos.^{m}X in a series of cosines or sines of multiples of X.

We have

$$2\cos.x = e^{x\sqrt{-1}} + e^{-x\sqrt{-1}},$$

$$\therefore 2^m\cos._m x = e^{x\sqrt{-1}} + e^{-x\sqrt{-1}})_m.$$

If this be developed by the binomial theorem, we obtain

$$2^m\cos.^m x = e^{mx\sqrt{-1}} + \text{A}e^{(m-2)x\sqrt{-1}} + \text{B}e^{(m-4)x\sqrt{-1}} + \ldots.$$

where

1, A, B, C, ...

are the coefficients of the binomial series.

Eliminating e by the general formula,

$$\cos.mx + \sqrt{-1}\sin.mx = e^{mx\sqrt{-1}},$$

we obtain

$$2^m\cos.^m x = \cos.mx + \text{A}\cos.(m-2)x + \text{B}\cos.(m-4)x + \ldots.$$
$$+ \sqrt{-1}[\sin.mx + \text{A}\sin.(m-2)x + \text{B}\sin.(m-4)x + \ldots.].$$

Let the first series be P_x, and the second Q_x, and we have

$$(2\cos.x)^m = \text{P}_x + \sqrt{-1}\text{Q}_x.$$

Let cos.x be first supposed to be positive, and in that case $(2\cos x)^m$ must have at least one real value. Let this be X, and all its other values will be found by multiplying X by the values of $(1)^m$. They are, therefore, all expressed by the formula

$$\text{X}(\cos.2mn\pi + \sqrt{-1}\sin.2mn\pi),$$

n being any integer not exceeding the denominator of m.

Also, in

$$(2\cos.x)^m = \text{P}^x + \sqrt{-1}\text{Q}_x,$$

no change is made in the first member by changing x into $2n\pi + x$, and therefore

$$(2\cos.x^m = \text{P}_{2n\pi+x} + \sqrt{-1}\text{Q}_{2n\pi+x}$$

Hence

$$\text{X}\cos.2mn\pi + \sqrt{-1}\text{X}\sin.2mn\pi = \text{P}_{2n\pi+x} + \sqrt{-1}\text{Q}_{2n\pi+x} \cdots [1$$

Equating the real and imaginary parts of this equation, we find

$$\text{X} = \frac{1}{\cos.2mn\pi}\text{P}_{2n\pi+x}, \quad \text{X} = \frac{1}{\sin.2mn\pi}\text{Q}_{2n\pi+x} \cdots\cdot [2].$$

Hence it appears that the real and positive value X of $(2\cos.x)^m$ can be indifferently expressed, either in a series of powers of the cosines or sines of the multiples of x, and that the two series differ from one another only in the constant coefficients.

Between the two series thus found, there subsists a constant relation:

$$\frac{\cos.2mn\pi}{\sin.2mn\pi} = \frac{\text{P}_{2n\pi+x}}{\text{Q}_{2n\pi+x}};$$

by which it appears that these series have a constant ratio, whatever be the value ascribed to x, from 0 to $\frac{\pi}{2}$.

If $n = 0$, we obtain by [2]

$$\text{X} = \text{P}_x,$$

which is therefore perfectly general, provided x be supposed less than $\frac{\pi}{2}$, and X confined to the real and positive value of $(2\cos.x)^m$.

The second formula of [2] gives $\sin.2m.n\pi=0$, ∵

$$X=\frac{0}{0}.$$

This fails in giving any value of X, but shows that $Q=0$

for all values of x from 0 to $\pm\frac{\pi}{2}$.

If the $\cos.x$ be negative, let $(2\cos.x)^m$ be expressed thus,

$$(-2\cos.x)^m=(2\cos.x)^m(-1)^m=\mathrm{x}(-1)^m.$$

But since

$$(-1)^m=\cos.m(2n+1)\pi+\sqrt{-1}\sin.m(2n+1)\pi.$$

Hence

$$\mathrm{x}\cos.m(2n+1)\pi+\sqrt{-1}\mathrm{x}\sin.m(2n+1)\pi$$
$$=P_{2n\pi+x}+\sqrt{-1}Q_{2n\pi+x}.$$

By equating the real and imaginary parts, we find

$$X=\frac{1}{\cos.m(2n+1)\pi}P_{2n\pi+x}\ \ldots\ldots[3],$$
$$X=\frac{1}{\sin.m(2n+1)\pi}Q_{2n\pi+x}\ \ldots\ldots[4],$$

In which the integer n is susceptible of any value from 0 to the denominator of m.

If $n=0$, we have

$$X=\frac{1}{\cos.m\pi}P_x,\ X=\frac{1}{\sin.m\pi}Q_x,$$

which give developments of the real value of $(2\cos.x)^m$ when $\cos.x$ is negative.

From this it appears that Q_x is not $=0$ as in the former case, where $\cos.x$ was supposed positive.

But although $Q_{2mn\pi+x}$ may not $=0$ when $n=0$, yet there may be some other value of n, which will render this series $=0$. To discover this, let it be determined what value of n will satisfy the condition,

$$\sin.m(2n+1)\pi=0,$$
$$\because\ \cos.m(2n+1)\pi=\pm1.$$

That these conditions be fulfilled, it is necessary that $m(2n+1)$ be an integer. Let $m=\frac{m'}{n'}$, and let I be any integer, ∵

$$m'(2n+1)=\mathrm{I}n';$$

but m' being prime to n' measures I. Let $\frac{1}{m'},=i$, ∵

$$2n+1=in'.$$

Since $2n+1$ is odd, both i and n' must be odd. But since n is supposed not to exceed n', i must be $=1$.

Hence

$$n=\frac{n'-1}{2},$$

which is therefore the only value of n which can satisfy the proposed condition.

Hence, if m be a fraction with an odd denominator (n'), we have

$$X=\pm P_{(n'-1)\pi+x},\quad Q_{(n'-1)\pi=x}=0,$$

$+$ being used when m' is even, and $-$ when odd.

But if m be a fraction with an even denominator, there is no arc $(2n+1)\pi$ which can render $\cos.m(2n+1)\pi=\pm1$; and, consequently, no arc $2mn\pi+x$ for which the series P_x can become equal to the real value of $(2\cos.x)^m$.

By the formulæ [3], [4], it follows that when $\cos.x$ is negative, the real and positive value of $(2\cos.x)^m$ may be expressed either in a series of sines or cosines of the multiples of x, and that the two developments differ only in the coefficients; and finally, that their ratio is the same for all values of x between $\frac{\pi}{2}$ and $\frac{3\pi}{2}$.

The development which has been thus obtained gives the value of the mth power of the cosine of an arc in a series of cosines or sines of its multiples. Similar series for the mth power of the sine may be obtained in a similar way.

By expanding

$$(2\sin.x)^m(\sqrt{-1})^m=\left(e^{x\sqrt{-1}}-e^{-x\sqrt{-1}}\right)^m,$$

and eliminating e by the formula,

$$\cos.mx\pm\sqrt{-1}\sin.mx=e^{\pm mx\sqrt{-1}},$$

we obtain

$$(2\sin.x)^m(\sqrt{-})^m=\cos.mx-A\cos.(m-2)x+B\cos.(m-4)$$
$$+\sqrt{-1}[\sin.mx-A\sin.(m-2)x+B\sin(m-4x)$$

the series be called P_x and Q_x, we have

$$(2\sin.x)^m(-1)^{\frac{m}{2}}=P_x+\sqrt{-1}Q^x.$$

This formula being treated in a manner similar to that for $(2\cos.x)_m$, will give similar results.

TRINCOMALEE. See Ceylon, Vol. V. p. 576.

TRINIDAD, an island on the east coast of South America, within ten or eleven miles of the continent. It is of an irregular square form, about thirty leagues long, and from two to ten leagues broad.

It is the largest and finest of the Leeward Islands, abounding with the noblest forests, and possessing a soil fitted for the growth of every article of West India produce. The northern part of the island is covered with a ridge of mountains which end with point Galera, and seem to have been a continuation of the Parian Mountains on the continent. They consist of gneiss, and mica slate, with great masses of quartz, and of compact bluish grey limestone. For many leagues to the south, there is little else than a thick fertile argillaceous soil, without a stone or a single pebble. The purest streams issue from both sides of these mountains, and form on the south the river Caroni; which is navigable by canoes and floats for some distance into the interior. The ridge of the Montserrat hills begin at L'Ebranche on the east side, and stretch in a south westerly direction.

The forests contain the finest wood for ship building and ornamental purposes; among which are the red cedar, and a great variety of palms. The articles of West India produce which are extensively cultivated are, sugar, cocoa, indigo, coffee, tobacco, cinnamon, and cloves. There are extensive savannahs on the island, on which quantities of cattle, horses, and mules are fed in common. Game abounds in the woods, particularly deer, the lap, the cuenca, a species of wild hog of exquisite flavour, and a variety of other kinds. Among the birds are the wild turkey, the raimier, and the parrot. The coasts abound in various kinds of fish. The mangrove oyster, which breeds on the branches of the trees of this name, are very abundant. Lobsters, crabs, shrimps, and prawns are plentiful.

The climate is considered to be as healthy as in any part of the New World. The winter or rainy season begins in June, and terminates in October. The fine season begins in November, when the cold north-east winds from North America give freshness to the air. Among the healthiest and mildest parts of the island are the vallies of Sta Anna, Maraval, Diego, Martin, Aricagua, and the heights of St Joseph to the north-west, and the vallies on the north coast. In spring, the thermometer stands in the day at 80° of Fahrenheit. During the night it descends to 60° and sometimes to 50° in places of moderate elevation.

Among the objects of particular interest in this island, are the pitch or tar lake of Brea, and the Mud volcanoes.

The pitch lake or plane is situated on the leeward side of the island, on a point of land extending about two miles into the sea, and opposite to the Parian Mountains on the continent. The headland is about fifty feet above the sea, and is the highest point on this side of the island. When seen from the sea it resembles a dark scoriaceous mass, but when more closely examined, it is found to consist of bituminous scoriæ, vitrified sand, and earth, all cemented together. In some places only beds of cinders are found; a strong sulphureous smell is felt on approaching this cape, and it prevails in many parts of the ground to the distance of eight or ten miles from it. The bituminous plain occupies the highest part of the point of land which shelves into the sea, and the plain is separated from the sea by a margin of wood which surrounds it. At first it resembles a lake of water, and in hot and dry weather it is actually liquid to the depth of about an inch. It is of a circular form, and about three miles in circuit, bounded on the north and west by the sea, on the south by a rocky eminence of porcelain jasper, and on the east by the usual argillaceous soil of the country. Its more common consistence and appearance are those of pit coal, but of a greyish colour. Dr Anderson regards it as the bitumen asphaltum of Linnæus. It is ductile by a gentle heat, and when mixed with grease or common pitch, it is much used for the bottoms of ships, and is regarded as a preservative against the Teredo navalis, which is so destructive to ships on all the coast of Guaiana. The Spanish government found out its value, and intended to have made use of it in their naval yards.

According to Dr Nugent, who has more recently examined this lake, the bituminous substance is asphaltum, which is traversed by numerous and sometimes deep crevices filled with good water, which the inhabitants use, and in which mullet, and other species of fish are often caught. Its surface had the colour of ashes, and did not adhere to the foot, from which, however, it received a partial impression, but not so as to be dangerous to walk over it. Pieces of unaltered wood were found enveloped in the pitch. The lake contains many islets covered with long grass and shrubs, which are the haunts of birds of the most exquisite plumage, as the pools are of snipe and plover. Alligators are said to abound here, but Dr. Nugent did not see any of them. The asphaltum is sometimes black and hard, with a dull conchoidal fracture, but in general it may be easily cut, and its interior appears oily and vesicular. At a candle it melts like sealing wax, and burns with a flame which soon ceases when removed. It acquires fluidity when mixed with oil, butter or tar, and is used as pitch. Dr. Nugent found petroleum perfectly fluid in one part of the lake, and Captain Mallet, in his topographical sketch of the island, observes that "near Cape La Brea, a little to the south-west, is a gulf or vortex, which in stormy weather gushes out, raising the water five or six feet, and covering the surface for a considerable space with petroleum or tar." He adds, that on the east coast on the Bay of Mayaro, there is another gulf similar to the former, which in March and June detonates like thunder, having some flame with a thick black smoke, which vanishes immediately. In about twenty-four hours afterwards, there is found along the shore of the bay a quantity of bitumen about three or four inches thick. Captain Mallet likewise quotes Gumilla, as stating in his description of the Orinoco, that about seventy years ago, "a spot of land on the west coast of this island, near half way between the capital and an Indian village, sank suddenly, and was replaced by a small lake of pitch, to the great terror of the inhabitants."

In confirmation of the truth of these statements, it may be added, that in many parts of the lake, the pitch seems actually to have overflowed like lava, and leaving the wrinkled appearance which a sluggish substance would exhibit in motion.

On first viewing the pitch lake of Trinidad, Dr. Nugent remarks, that the singularity of the scene was altogether so great, that it was some time before he could recover from his surprise so as to investigate it minutely.

The Mud volcanoes of Trinidad resemble those observed by Humboldt in South America. The following interesting description of them has been given by Dr. W. Ferguson in the Edinburgh Transactions:

"They are situated near Point Icaque, the southern extremity of the island, on an alluvial tongue of land, that has been appended to the primitive rocks, where no doubt the land originally terminated. This appendage is several miles in length, and points directly into one of the mouths of the Orinoco, on the mainland, about twelve or fifteen miles off.

"We landed nearly opposite to where we were told we should find the mud volcanoes, and after making our way about five miles through the woods, across the sandy isthmus, we came upon two plantations very pleasantly situated amidst a group of remarkable round little hills, each from eighty to a hundred feet in height. Our path on leaving these, led us through some very thick wood of tall trees, till we found ourselves again upon a pretty steep regular ascent, which had nothing remarkable in it, except the diminishing height of the trees as we went up. Only the tops of these trees, which were of the kind that usually grow near lagoons and salt marshes, at last appeared above the ground, as we opened a perfectly uniform round bare platform, of several acres, with different chimneys in the shape of truncated cones, the highest of them not exceeding three feet, some of which were throwing out, with a strong bubbling noise, salt water, about as salt as that of the Gulf of Paria, loaded as much as it could be, to preserve its fluidity, with argillaceous earth. In some of the chimneys this went on slowly, or not at all; in others it might be called a pretty active cold ebullition. The surface of the platform round the chimneys was perfectly firm, and one of our party picked up a white sea shell, of the turbinated kind, in the act of being thrown out along with the mud.

"We afterwards procured various pyritic fragments that had been picked up in a similar manner; but the inhabitants in the quarter assured us, that the ebullition, even during its greatest activity, was quite cold. The smooth circular platform was bounded by a perfect regular parapet of clay, about three feet in height, propped up, as it were, by the tops of the trees, that, like shrubs, were shooting out of the ground immediately behind it. This appearance was most likely to be referred to the buried trees around, having had time to shoot out in the interval between the two last great eruptions, which takes place only during the hottest months of dry seasons, and then the noise is described to be like the loudest cannon, the mud being thrown up to the height of at least thirty feet in the air, and the theatre of the eruption being unapproachable within fifty paces.

"Close to the first volcano, but in a much more low and sunk situation, is another of precisely the same appearance and character, with only a narrow ravine between the two.

"Such an extraordinary phenomenon induced us to examine the neighbouring mounts of the cleared country, close to the nearest of which stands the residence of Monsieure Chancelier, a French planter, and we found them all, (bating only the eruption) to possess the same form and composition in all respects as those we had just quitted. The platform and parapet were easily distinguishable, the chimneys only were gone, but just small pits were left in their places, filled with mud, from which air-bells rose even under our own observation, and our conductor, the intelligent manager of the estate, told us, that when these rose in salt water, a fresh eruption was to be apprehended. He pointed out the former site of his master's residence, half up the mount, which had been destroyed by one of these eruptions, after a period of cessation so long, that no record remained of the one that had preceded it, and he assured us, that during the period he had lived there (fourteen years) the largest mount now in activity had gained a very considerable increase of height.

"The magnificent isolated mountain of Tamanaa, in the centre of the great eastern marsh, unconnected with any chain of hills, and at an immense distance, on every side, from what may be called *terra firma*, may be supposed, till examined, to have arisen from the plain, through the means of some similar elaboratory in the works of nature. I have said, till examined, for its approaches are so barred by the thickest wood and deepest swamps, where the boa, the alligator, and all the venemous reptiles of the parent continent still retain the sovereignty of the soil, that the most determined and enterprising have never yet been able to penetrate to its base."

All the rocks of Trinidad are either decidedly of primitive or alluvial origin.

Port Spain, the seat of the government, is built on a bed of gravel 30 or 40 feet deep, resting on a substratum of clay. It is one of the handsomest towns in the British colonies. The new and beautiful protestant church, designed by Mr. Reinagle, is much admired.

Trinidad was discovered by Columbus on 31st July 1498, but the Spaniards did not occupy it till 1588, after which they had almost destroyed the Indian inhabitants. The island now belongs to Great Britain. Its population in 1807 consisted of 71,000, of which 21,000 were slaves. The Lon. of the protestant church in Port Spain is 61° 35′ 00″ W. and the Lat. 10° 38′ 56″ N. For farther information respecting Trinidad, see Anderson in the *Philosophical Transactions*, vol. lxxix, or *Annual Register*, 1789. Captain Mallet's *Topographical Sketches* of Trinidad. Dr. Nugent, in the *Geological Transactions*, vol. i. and Dr. Ferguson in the *Edinburgh Transactions*, vol. ix. p. 93. See also our articles Abercrombie, Sir Ralph, Vol. I. p. 15, Caraccas, Vol. V. p. 318, Britain, Vol. IV. p. 645, and South America, Vol. XVII.

In continuation of the foregoing article we may add that this island, originally named by Columbus La Santissima Trinidad, the Holy Trinity, lies off the province of Cumana, in Colombia, and between the estuary of the Orinoco river and the island of Tobago. As laid down on Tanner's Map of Colombia, it extends from Lat. 10° 6′ to 10° 52′ N., and between Lon. 15° and 16° E. from W. C. The form of this island is very singular. The central and main body lies nearly in the form of a square, but from each angle protrudes a salient point. These points are named Punta Galeota S.E.; Punta de la Galera N.E.; Punta de Yeacos S.W.; and Punta Coroval to the N.W. The latter projects westward towards Punta de la Pena, in Cumana, with the straits of Dragon's Mouth intervening. A single glance on a map of South America and adjacent islands, almost superinduces the affirmative of the theory, that the mountainous chain sometimes called the Venezuelean Andes, and again the Sierra de Paria of Cumana, is continued over the Dragon's Mouth, in the islets Chacachacares, Huenos, and de Menos; over the northern part of Trinidad in the chain of Castillo, and finally in the island of Tobago.

From this northern chain Trinidad spreads to the southward about 45 miles, with a mean breadth of 40 miles. The entire area is estimated at about 1800 square miles.

This island has experienced the vicissitudes of war and conquest, being successively invaded by the English and French. Held alternately by Great Britain and Spain, it was ultimately ceded to the former by the treaty of Amiens, 1802.

Obtained by conquest it is a crown colony, and by recently published statistical tables the

White population amounts to	13,500
Black and coloured do. free,	16,000
Do. do. slaves,	23,000
Total,	52,500

This amount, if correct, yields a distributive population of 29 to the square mile, of which about one-fourth are whites.

Inclosed between this fine island and the continent of South America, extends the Gulf of Paria, spreading westward towards the mouth of the river Guarapiche of Cumana, 80 miles, varying from 40 to 50 miles in width, and terminating to the S.E. opposite to the north of the Orinoco, in the straits of the Serpent's Mouth. By the latter passage, or that of the Dragon's Mouth to the north, only can access be had by sea to the western side of Trinidad, and to its capital and principal mart, Port Spain.

Port Spain is situated on the Gulf of Paria, about 20 miles inside of the Dragon's Mouth, N. lat. 10° 36′, Lon. 15° 22′ E. of W. C.

TRINIDAD, seaport of Central America, in Guatemala, situated on the bay of Acazulta, of the Pacific Ocean, N. Lat. 13° 50′, N. Lon. 12° 40′ W. of W. C. It is important from being the only port for a considerable distance on either side along the coast of Guatemala, and it is situated about 100 miles S.E. by. E. from the city of Guatemala.

TRINITY, river of Texas, having its remote sources near the right bank of Red River, between those of the rivers Brassos de Deos and Sabine, about N. Lat. 33°, and Lon. 19° W. from the meridian of W. C. The entire length of the Trinity is a little above 300 miles, with a general southern course, but similar to the Colorado, Brasso de Deos, and Sabine, with an elliptic curve to the eastward. Galveston Bay is the estuary of the Trinity, spreading between 18° and 19° W. from W. C. The country watered by the Trinity is generally sterile plains, and in great part unsettled, but like other rivers disemboguing into the northern coast of the Gulf of Mexico, much excellent land skirts the streams. Darby.

TRIPOLI, a seaport town of Africa, and capital of a territory of the same name. It is situated on the southern coast of the Mediterranean, on low ground, upon a neck of land projecting into the sea, which washes the town on three sides. Its high strong walls, flanked with six pyramidal towers, inclose a large space of ground, most of which is unoccupied. The streets are narrow, dirty, and irregular. The mosques and caravanserahs, the houses of foreign consuls, and those of the higher class of natives, are built of stone and whitewashed twice a year. The better kind of houses are two stories high; but those of the lower ranks are of one story, and are built of bricks, small stones and mortar. They are built of a square form, with a court in the centre paved with Maltese stone. The roofs, which are flat, serve for a promenade, and as a receptacle for rain water, which is conveyed into cisterns below by means of pipes. The castle or royal palace, the residence of the bashaw, is at the east end of the town within the walls, with a dockyard adjoining. The castle is an irregular square pile, and looks respectably when seen from the harbour. The ramparts, which are lofty, are well supplied with brass cannon. The Franciscans have here a handsome church, convent, and hospital. The mosques have generally a small plantation of Indian figs and dates close to them, which gives an agreeable aspect to the town.

The public baths form clusters of cupolas, very large, to the number of 9 or 10, crowded together in different parts of the town. They are of the same kind as those said to be used in Turkey and Egypt, though not so magnificent in point of ornament or size. The price of the bath alone without soap is only fivepence. The bazaars occupy a large portion of the city, and are kept in good order. They are streets covered in overhead, and are opened every day. The shops of merchants are ranged on each side, and are very small. Slaves and goods are carried about before the traders by auctioneers, who keep up a constant noise, calling out the last bidder's price. The Jews have a quarter of the town expressly to themselves, where they have their shops, and in which they are shut up every evening at sunset. This place is named Zunga t'el Yahood. The Jews suffer great persecution, and are forced to do the duty of executioners, yet they continue to engross all the trade and places of profit. They are precluded from wearing gaudy clothes, and are allowed only blue turbans.

A number of houses called Findook, resembling the caravanserahs of the east, are set apart for the reception of merchants and their goods. There are a few schools at Tripoli, where reading and writing, to a small extent, are taught in a very noisy manner.

Drunkenness is a common vice here. There are public winehouses, at the doors of which the Moors sit and drink without scruple. The better sort of people all drink hard. Their favourite beverage is rosolia, an Italian cordial. Prostitutes, who are very numerous, are confined under a superintendent to a particular part of the town. These women are obliged daily to supply food for the bashaw's dogs which guard the arsenal.

The principal monument of antiquity at Tripoli is a superb triumphal arch, built of fine marble, and adorned with several bas reliefs and inscriptions. A great part of it is buried in the ground, and the upper part of it is much mutilated. It is now used as a warehouse, and stands near the sea gate. The inscription over the northern face is in a perfect state, and indicates that it was erected in the reign of M. Aurelius Antoninus. Captain Lyon has copied the inscription, and given a fine representation of the building.

The harbour of Tripoli is formed by a reef of rocks, projecting from the west end of the town into the sea; and as it extends in an easterly direction, it affords great shelter to shipping during the north-easterly gales, which are the most dangerous. It admits small frigates not drawing above 18 feet of water. The naval force does not exceed six armed vessels mounting from 6 to 16 guns. The admiral of the fleet, now called Murad Rais, was originally a Scotsman of the name of Peter Lysle. He was in banishment when captain Lyon was at Tripoli, but he learned from the consul and the chief people that he was an excellent character. The bashaw has no regular army. A force of 4000 or 5000 men is generally on foot, though he can upon an emergency raise 15,000.

There are two good markets held every week, one every Tuesday on the sands behind the town, and the other on Friday about four miles distant among the gardens of the Meshea, which form a stripe about three or four miles broad between the beech and the desert.

The trade of Tripoli is chiefly carried on by Turkish and Maltese vessels, with Malta, Tunis, and the Levant. The exports are excellent wool, senna, and other drugs, madder root, hides, barilla, dried skins, salt, native ostrich feathers, gold dust, gums, ivory, dried fruits, saffron, poultry, sheep and bullocks. The articles of import are cloths of all kinds, tea, sugar, coffee, woollen goods, silks, damasks, gold and silver lace, dyes, iron, cutlery, gunpowder, arms, naval stores, toys, &c. The annual caravan from Morocco to Mecca passes through Tripoli.

The following has been given as the bashaw's revenue in Spanish dollars.

The governors of Derne and Bengazi remit about	22,000
Custom duties, with the farm of spices and tobacco	20,000
Farming of wine and spirits	20,000
Produced on the sale of barilla	20,000
Gold dust from Ghadamis	4,000
Annual tribute of the slaves from Fezzan	4,000
Farming of soap	3,000
Tribute from the Jews	2,000
Total	95,000

Besides these sources of revenue, there is an impost on every well and date tree, a tithe of the produce of lands, &c. and the profits of piracy. Population about 25,000. East Lon. 13° 18′, and North Lat. 32° 59′. See Tully's *Narrative of a Ten Years Residence in Tripoli*, Captain Lyon's *Narrative of Travels in North Africa*, chap. i. and our article BARBARY, Vol. III. p. 250.

TRIPOLI, a seaport town of Syria, and chief place of a pachalic of the same name. It stands at the foot of Mount Lebanon, which overlooks and surrounds it with its branches to the east and the south. The town, which is three quarters of a mile long, by three hundred yards broad, is separated from the sea by a small triangular plain half a league broad, at the point of which is the small town of La Marina, which forms the port of Tripoli. The small river Kadisha runs through the town, but its shallows and rapids prevent it from being navigable even by boats. The town is defended by an old Saracen fort situated on the banks of the Kadisha, on the south side of the town, which is commanded by a height only 150 yards distant. The plain above mentioned is wholly covered with trees, chiefly mulberry, for the food of silk worms, which are reared to a considerable extent. Silk is, indeed, the staple commodity of the place, and is exported both raw and in the form of handkerchiefs. Soap and oranges are among the other articles of export. The imports are cloths, cochineal, sugar, and West India coffee. East Lon. 35° 44′. North Lat. 34° 26′. See Volney's *Travels in Syria*, &c.

TRIPOLIZZA, a town of Greece in the Morea, situated in a narrow valley at the foot of Mount Mænalus. The streets, with the exception of the principal one, are dirty and paved only in the middle. The houses, which have a poor appearance, are built of unburned brick. The chief buildings are the residence of the pacha, a square structure of wood, with walls and gates, the khan for travellers, and the bazaar. The population is about 12,000.

TRISTAN, D'ACUNHA, the name of the largest of three islands in the South Atlantic ocean, situated nearly 1500 miles from any land. The island is about 15 miles in circuit. On the north is rises perpendicularly from the sea to the height of 1000 feet, and from the table land thus formed, a conical mountain, like the Peak of Teneriffe, rises in the centre of the island. South Lat. 37°. Lon. 15° 40′ West.

TRIUMPHAL ARCH. See CIVIL ARCHITECTURE, *passim*, and Vol. VI. pp. 439, 458, 463. See also ROME.

TROAD, or PLAIN OF TROY, a name given to the site of the Trojan War. See our article HOMER, Vol. X. p. 461, for a notice on this subject. Those who wish for ample information may consult M. Chevalier's learned Memoir in the *Edinburgh Transactions*, vol. iii. part ii. sect. 2.; a Memoir by Mr. Dalzel, in the same work, vol. iv. p. 29; Jacob Bryant's *Observations on M. Chevalier's Memoir*, 1776; Bryant's *Dissertation on the Trojan War;* Gilbert Wakefield's *Letter to Mr. Bryant, on his Dissertation on the War of Troy.* Lond. 1797. Heyne's *Topography of the Iliad;* Dallaway's *Constantinople, &c. with an Excursion to the Troad, &c.;* Chandler's *History of Ilium*, Lond. 1802; Wood's *Essay on Homer;* Gell's *Topography of Troy*, and an admirable Dissertation by Dr. Clarke, forming chap. iv. of the second volume of his *Travels*.

TROSACHS. See PERTHSHIRE.

TROUP, county of Georgia, bounded N. by Carroll county in the same state, E. by Merriwether, S. by Harris, and W. by the territory of the Creek Indians in Alabama. As laid down by Tanner in his United States, this county is 25 miles long from south to north, with a mean width of 19, and with an area of 475 square miles. Extending in Lat. from 52° 54′ to 33° 15′ N., and in Lon. from 8° 2′ to 8° 22′ W. from W. C. This county is traversed in a S.S.W. direction by Chattahooche river, dividing it into two unequal sections, the much larger being eastward from the river. General declivity S.W.

La Grange, the seat of justice, is situated near the centre of the county, on Yellow Jacket creek, by post road 133 miles almost due W. from Milledgeville. N. Lat. 33° 06′, and Lon. 8° 11′ W. from W. C. DARBY.

TROWBRIDGE, a manufacturing town of England, in Wiltshire, is situated on an eminence near the Were, a little above its junction with the Avon. The streets, which run nearly north and south, are very irregular, and the houses are in general ill built. The church is a spacious fabric, with a lofty tower and tapering spire. There are several meeting houses for dissenters. The inhabitants are chiefly employed in the woollen manufacture, and some of the manufactories are handsome and substantial buildings. The cloths which are made here are fine broad cloths and kerseymeres, 90 pieces of the former and 490 of the latter having at one time been made weekly. The trade of the place is greatly facilitated by the Kennet and Avon canal. The population of the parish, in 1821, was—houses 1786, families 2169, inhabitants 9545.

TROY, city, is the shire town of the county of Rensselaer, in the state of New-York. It is situate on the east side of the Hudson river, at the termination of its tide and navigable waters, one hundred and sixty miles north of the city of New York, and six miles north of the city of Albany. Its chartered limits are bounded north by the village of Lansingburgh, on the east and south by the townships of Brunswick and Greenbush, and on the west by the middle of the Hudson river, which, opposite to the city, varies from 700 to 1400 feet in breadth. These limits extend from south to north about three and a half miles, and from the bank of the river easterly one mile, to which a small additional territory has been added on the south-east.

That part of the city limits which is most populous, and now nearly covered with buildings, is situate on a nearly level plane, which rises abruptly from the river to the height of about 25 feet, extending about one and a half miles in length along the river and about half a mile back. Dock and River streets meander with the river; the other seven north and south streets are straight, and 60 feet broad, with a like number of narrow streets called alleys passing through the middle of each block. These are crossed with other streets at right angles, extending from the river easterly.

River street is the great street of business. The large stores or warehouses, built on its west side, are mostly of brick or stone, and, being built on the bank or rise from the river, are from four and a half to six and a half stories high on the side adjoining the wharves, and two and a half to three and a half stories on the east or River street side. On the east side of River street, as also in first, second, third, and fourth streets, the houses and stores are mostly handsome modern brick buildings. Among the public buildings entitled to particular notice are St. Paul's church and the city hall or county court house; the latter built in imitation of the ancient temple of Theseus in Greece, and, like its prototype, entirely of marble, excepting the covering of the roof which is of copper, and excepting also that this has pillars only in front. It is 103 feet long and 60 broad, with side walls 50 feet in height, and for elegance, simplicity, and durability, is strikingly appropriate.

St. Paul's church is built in gothic style, of bush-hammered, dark coloured, secondary lime-stone, 113 feet long, 70 broad, with side walls 42 feet high, presenting the appearance of great strength, durability, and fine finish.

Troy was divided into six wards, and incorporated as a city in 1816. It is governed by a common council, consisting of a mayor, recorder, six aldermen and four assistant aldermen, who have power to enact laws for regulating the concerns of the city, to raise moneys by tax, and appoint subordinate officers. The aldermen and assistants are elected annually by persons qualified to vote; the mayor is elected by the common council, and the recorder is appointed by the governor of the state, with the consent of the senate.

The religious establishments are two Episcopalian churches; two Presbyterian; one Baptist; one Universalist; one Friends' meeting house; one Methodist; and one Roman Catholic chapel.

Literature. The literary institutions are, first, a

Lancasterian school for the education of children of all denominations and descriptions of persons. Second, a high school, for the higher branches of English education, intended to afford to young men the means of cheap and efficient preparation for college, or such as to enable them to dispense with a collegiate education. Thirdly, an infant school for children under the age of six years. Fourthly, a female seminary, intended exclusively for young ladies in all the higher branches of education. Mrs. Emma Willard, a lady possessing pre-eminent characteristics and qualifications for the station, is the principal preceptress of this school, to whose labours the city is much indebted for its introduction and high standing; for the three years last past the number of pupils have exceeded two hundred. The buildings for the accommodation of these schools are large and comfortable. They were erected at the expense of the city, and their general supervision confided to boards of trustees annually appointed for each respectively by the common council, except the infant school, which is under the control of a society of ladies, who, in addition to appropriations by the city, contribute liberally to its support. Fifthly, the Rensselaer school. This school was established and endowed by the Hon. Stephen Van Rensselaer, for the instruction of young men in all the modern arts and sciences, and more especially chemistry and geology, as bearing upon the arts and agriculture. These several schools are in addition to the common schools established under the general school law of the state, of which there are many, and altogether giving to the rising generation the most ample means of acquiring useful knowledge.

Manufactories. There are two manufactories of cottons and one of woollens on a large scale; seven merchant mills for flowering; and several rolling, slitting, and nail and spike manufactories, which are also carried on extensively. These, with a paper mill, oil mill, and several minor concerns, are driven by the waters of the Poestien and Wynants Kills, which fall into the Hudson within the city—which, with several extensive tanneries, three large brewing and malting establishments, two extensive coach and carriage manufactories, coopering shops, hat manufactories, and air furnaces, constitute, severally, large branches of business, giving employment to many hands and much capital.

Commerce. The commerce of Troy, in the aggregate, has always been on the advance, but more especially so, since the opening of the canals. It has now many importing wholesale merchants, and numerous retail stores. Its commercial connexions extending not only to the countries intermediate, but to the furthermost lakes west and north; from these it receives wheat and grain of all kinds, flour, pot and pearl ashes, furs, beef, pork, butter, lard, cheese, wool, salt, manufactures of cotton and woollens, flaxseed, whisky, and large quantities of lumber, boards, planks, timber, shingles, &c. &c., and sends them in exchange the manufactures and commodities of this and foreign countries. The transportation of these commodities to and from the port of New York, where most of this trade centers, and to other parts and places, gives employment to more than 80 river sloops, averaging about ninety tons each, besides 12 boats of 150 tons each towed by steam. There are also three public banks with extensive capitals in good credit, and one savings bank; two fire insurance companies, and three semi-weekly newspapers.

Population	by U.S. census of 1810,	3985
do.	by U.S. census of 1820,	5266
do.	by State census of 1825,	7859
do.	by U.S. census of 1830,	11,587

Tibbits.

TROYES, a town of France in Champagne, and capital of the department of the Aube. It is situated on the Seine, and surrounded with a wall. The houses, which are chiefly of wood, have a very poor appearance. The chief public buildings and institutions are the cathedral, the churches of St. Etienne and St. Urban, the Hotel de Ville, the Lyceum, a public library, and the Society of Arts. There is a fine promenade along the ramparts. The articles of manufacture are cotton stockings, woollen and linen goods, leather, and thread. The trade consists in corn, wine, and fruits. Population 27,000. East Lon. 4° 4′ 49″. North Lat. 48° 18′ 5″.

TRUMPET. See Acoustics, Vol. I. pp. 113, 117, 118.

TRUMBULL, county of Ohio, bounded by Columbiana county in the same state S., Portage W., Geauga N.W., Astabula N., Crawford county of Pennsylvania N.E., Mercer of Pennsylvania E., and Butler of Pennsylvania S.E. It lies in form of a parallelogram, 36 miles from south to north, and 24 from east to west, area 864 square miles. Lying between 41° and 41° 32′ N., and between 3° 30′ and 3° 58′ Lon. W. from W. C. Declivity to the S.E., and drained by the Shenango and Mahoning branches of Big Beaver. A small section in the northwestern angle is, however, an exception; from that part flows the southern source of Grand river, and of course the surface declines towards lake Erie.

The soil of Trumbull is generally fertile. Surface moderately hilly.

Though not much above thirty years wrested from a wilderness, the advance of this county has been very rapid. In 1810, the population was 8671, in 1820 it had risen to 15,546.

By the post office list of 1831, there were offices at 30 places beside Warren, the county seat.

Warren, the seat of justice, is situated on the left bank of Mahoning river, very near the actual centre of the county, about 80 miles N.W. from Pittsburgh, 60 S.E. by E. from Cleaveland, and by post road, 297 miles N.W. by W. from W. C., and 157 N.E. from Columbus. N. Lat. 41° 15′. Lon. 3° 45′ W. from the meridian of the capitol at Washington.

Darby.

TRURO, a town of Cornwall, situated in a valley in the parishes of St. Mary, Kenwyn, and St. Clements; it is bounded on the south-west and north by Kenwyn and on the east by St. Clements; its site is between the Kenwyn and Allen, which uniting form a branch of the Fal, navigable to the town at spring tides for vessels of 100 tons burthen. It is said to have been fortified by a castle, of which nothing now remains but a mound, and as it is commanded by adjacent hills, it could never have been of much importance. The derivation of the name seems from the Corn British "Tri," three, and "Ru," street—in allusion to the meeting of the roads from St. Austle, Bodmin, and Redruth. After the conquest it was the property of Robert Earl of Moreton and Cornwall. By Richard de Lacy, to whom it descended, a charter and privileges were procured about A.D. 1130 or 1140. There is an endowed charity for widows, the building bearing date 1631; by it the objects are provided with four shillings per week and clothing. It also contains an infirmary, founded in 1799, and erected and supported by voluntary contributions. The church of St. Mary is of rich Gothic architecture, and is surmounted by an elegant spire; it bears date 1518. The parliament of Stannators for regulating the affairs of tin mines, and the court of the vice warden of the Stannaries are held here. It is also one of the three towns in Cornwall in which the duke of Cornwall's tin coinages are held. There are three large smelting houses for tin in the immediate vicinity. It possesses a library and Philosophical Institution; in the latter is a good collection of the natural productions of the county. Its population is from 7000 to 8000. It is 260 miles south-west of London, and 11 north of Falmouth. It returns 20 members to parliament; the power of election being vested in the mayor, 4 aldermen, and 20 capital burgesses. The present recorder is the Earl of Falmouth. Its principal trade is the importation of coal from Wales, and timber from Norway and America.

TSIAMPA. See SIAMPA, Vol. XVII. p. 270.

TUAM, a town of Ireland, in Galway, consisting of four streets which diverge nearly at right angles from the market house. The town is neat, well built, and thriving. The chief buildings are the cathedral at the end of the town, which is a neat edifice, with a lofty spire; the archiepiscopal palace; the Diocesan school house, and the market house standing on square stone pillars. The linen manufacture is carried on in the vicinity, and the place possesses an active retail trade. There is an elegant mall here.

TUBINGEN, a town of Wirtemberg, situated between two hills at the conflux of the Neckar and Ammer. It depends principally on its university, which was founded in 1477, and greatly improved in 1769. It was originally protestant; but after the suppression of the Catholic college of Elwangen, the Catholics were admitted to Tubingen. The students vary from 500 to 600. There is also here a seminary for the sons of families of rank, and a theological institution for educating 150 students as clergymen or schoolmasters. Attached to the university is a public library and botanic garden. The inhabitants have some employment in woollen manufactures. Population, 6000.

TUCUMAN. See BUENOS AYRES, Vol. IV. p. 781, and SOUTH AMERICA, Vol. XVII.

TVER, a town of Russia, and capital of a government of the same name. It is situated on the great road from Moscow to St. Petersburg, at the conflux of three rivers, the Tvertza, the Wolga, and the Tmaka, which are crossed by three bridges, and divide the town into six parts. The bridge over the Wolga is of boats, and is removed in winter. The town is divided into the old and new, separated by the Wolga; the former consisting almost wholly of wooden cottages, and the latter having been burned down in 1763. The Empress, in order to repair this disaster, ordered the town to be rebuilt upon a new plan, and advanced £60,000 for that purpose. The streets, which are long and broad, diverge from an octagon, and the houses in the principal streets are of brick, stuccoed white. There are also some handsome squares. Many of the houses are of stone, and Dr. Clarke says that the shops and churches merit particular regard. The principal public buildings are the Gothic cathedral, the palace, the courts of justice, the government offices, and the hospital. There is an ecclesiastical seminary here under the bishop, which admits 600 students. In 1776 the Empress founded a school for 200 children of burghers, who are taught reading, writing, and accounts. In 1779 she also established an academy for the education of the young nobility, which admits 120 students. The manufactures of the place consist of linen, wax candles, leather, and hardware articles. Its exports are corn, hemp, and iron. Pallas speaks of the delicious *sterlet* taken from the Wolga, with which travellers are regaled in this town at all seasons. Population of the town about 20,000.

The province of Tver contains about 24,100 square miles, and 1,000,000 inhabitants. It possesses some iron mines. Longitude of Tver 35° 57′ East, and Latitude 56° 51′ 54″ North. See Clarke's *Travels*, vol. i. p. 39, 40.

TULA, a large town of Russia in Europe, is situated in a smooth valley, at the conflux of the Tulpa and Upa. Before reaching this town from Moscow, it presents a considerable appearance. A very handsome church, with white columns, more like a nobleman's palace than a place of worship, appears on a height above the town, which occupies a very extensive site, and is filled with domes and spires.* The entrance to it, both on its northern and southern side, is through triumphal arches, made of wood, and painted to imitate marble. The streets of Tula are paved, and it presents a greater appearance of industry than is usual in Russia. Most of the houses are of wood, but those built of stone are considerable, and daily increase in number. The river is crossed with several bridges, some of wood and others of stone. The public edifices are the churches, the bishop's palace, the courts of justice, and the hospitals. There are two academies here, one for priests, another for the sons of genteel families.

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* A view of this is given by Dr. Clarke.

Tula is the great emporium of hardware for the whole empire, containing the imperial manufactory of arms, and manufactories of all sorts of cutlery and works in polished steel. There are also here tanneries, breweries, and soap works. The number of its merchants, including shipbuilders, is 4000; and its commerce, independent of the hardware manufactory, consists of European merchandise, Greek wares, and other productions of Turkey. The imperial manufactory of arms employs 6000 men. The iron mines in the vicinity are very considerable. They occupy an extent of more than 10 miles, and from them the celebrated forges of Demidoff, 38 miles from Tula, derive their ore. Dr. Clarke states the population at 30,000, but later estimates make it 40,000. East Lon. 37° 1′ 34″. North Lat. 54° 11′ 40″. See Dr. Clarke's *Travels*, vol. i. p. 179—186.

TULLAMORE, a town of Ireland in King's county, traversed by a river of the same name. It is a neat and well built town, with one broad street, containing many handsome houses. The church, market house, and barracks are the chief buildings. The linen manufacture is actively carried on here, and its trade is greatly facilitated by the grand canal, which enters the town. The splendid residence of Charleville Castle is close to the town.

TUMMEL. See PERTHSHIRE.

TUNBRIDGE, a market town of England in Kent, is situated on five branches of the river Medway, each of which is crossed by a stone bridge. The town consists chiefly of one long and broad street, kept remarkably clean, and containing many good houses. The church of St. Peter and St. Paul is large and handsome, and contains some good monuments. Near the principal bridge, built in 1775, is a wharf for the reception of timber brought hither from the Weald. The free grammar school is a commodious building. The picturesque remains of Tunbridge castle stand on the south-west side of the town, consisting of an entrance gateway, flanked by round towers, and in a state of tolerable preservation. Population of the parish in 1821: houses inhabited, 1155; families, 1407; inhabitants, 7406.

TUNBRIDGE WELLS, the name of a straggling village within five or six miles of Tunbridge, and celebrated for its mineral waters. It consists of four parts: Mount Ephraim, Mount Pleasant, Mount Sion, and the wells, which form the centre of the place. It resembles a large town in a wood interspersed with rich meadows, and inclosing a large common with walks, rides, and handsome rows of large trees. Near the wells are the markets, the medicinal water, the chapel, the assembly rooms, and the public walks. The upper walk was formerly paved with brick, but in 1795 with purbeck stone, which cost more than £100. The lower walk is chiefly used by servants and the peasantry. A portico, supported by Tuscan columns, extends the whole length of the upper walk, and on the left is a row of large flourishing trees, with a gallery in the centre for music. The accommodation here for visitors, both in the town and in private dwellings, is of the best description, and persons of rank and wealth have houses here for occasional or permanent residence. There is here a theatre, and a boys' and a girls' school, the former for 80, and the latter for 100 scholars. The trade of the place consists in the manufacture of a variety of toys, baskets, dressing boxes, desks, &c. called Tunbridge ware, and made of different kinds of wood. The rides and drives in the vicinity are beautiful. An analysis of the mineral waters has already been given in our article MINERAL WATERS, Vol. XIII. p. 406. See also Dr. Thomson's *Annals of Philosophy*, vol. viii. p. 169, for Dr. Scudamore's *Analysis*, and the *Beauties of England*, vol. viii. p. 1295.

TUNIS, a large city in Northern Africa, and capital of a territory of the same name, is situated at the bottom of a bay about ten miles south-west of ancient Carthage, and is about three miles in circumference. It stands on a plain encircled by considerable heights on all sides but the east, and is surrounded with lakes and marshes, which do not produce insalubrity, an effect which is ascribed by Baron de Tott to the depth of the valley, which obstructs the vapours of the channel and the lakes, and prevents them from putrefying, while Dr. Shaw attributes it to the number of aromatic trees which are used to heat their ovens and their baths.

The town is built with the greatest irregularity, and the streets are so narrow and dirty as to be almost impassable. The principal buildings are a great mosque, and a number of a smaller size; but the grandest building is the new palace of the bey, which is a Gothic structure of great beauty. The lower part consists of a variety of fancy shops, which are rented from the bey, and contain the productions of Tunis. The houses of European consuls are more like prisons than residences, and the Moorish houses are only a storey high, with flat roofs. The old fortified palace of the bey, called El Bardo, encompassed with walls and flanked with towers, stands two miles west of Tunis. There are here a few academies and schools, where reading, arithmetic, and the Koran are taught. The harbour and citadel of Tunis, called the Goletta, is situated six miles to the west. There is here a basin capable of containing all the vessels belonging to Tunis. Between Goletta and Tunis there extends a lake, separated from the sea by a narrow isthmus. It serves as a canal between the city and the harbour, and affords an ample supply of salt.

The citadel, called El Gospa, and the high walls which defend the city, form a very insufficient protection to it. The former is out of repair, and is besides commanded by the neighbouring heights. Near the centre of the city there is a piazza of great extent, which is said to have once contained 3000 shops for the sale of woollen and linen goods manufactured in the city. Besides the public buildings we have mentioned, there is an exchange, a custom house, and an arsenal. The principal exports from Tunis are wheat, barley, olive oil of excellent quality, wool, soap, sponges, and Orchilla weed. The imports consist of all kinds of European manufactures, West India produce, and cotton from the East Indies.

The population of the city is estimated at 12,000 houses, and 130,000 inhabitants, of whom 30,000 are Jews, and 1500 Christians. East Lon. 10° 20′. North Lat. 36° 44′. See Shaw's *Travels in Barbary*, and our article BARBARY, Vol. III. p. 250, for general information respecting Tunis.

TUNQUIN, or TONQUIN, or TUNKIN, the native name of which is *Huocanam*. The states under the power of the emperor of Tunkin are situated in the Peninsula beyond the Ganges, and extend from 9° to 23° of North Latitude, and from 118° to 127½° of Longitude, reckoning from Ferro. They are bounded on the north by China and the Chinese sea, on the south by the Chinese sea, and on the east by Siam. Tunkin, properly so called, extends from the 17th to the 23d degree of latitude. It is separated from China by deserts and by inaccessible mountains, the only pass in which is shut up by a wall with a gate, which is guarded on each side. Tunkin is divided into ten provinces, of which the four situated at the extremities bear the name of one of the cardinal points to which they correspond. The capital is called *Bac-Kinh*, though originally *Keeho*.

Mountains running from east to west divide Tunkin into two parts, the northern exceeding the southern.

Tunkin possesses more than fifty rivers, which flow into the sea. That which has the largest course is formed by the union of two, one of which has its source in China, and passes Bac-Kinh. It contains numerous islands, and though there is a bar at its mouth, yet Chinese vessels from 400 to 500 tons, which draw little water, can navigate it to Bac-Kinh. To the south of the embouchure of the Saigong there is a sound capable of holding the largest vessels, but ships can only get out of it by a single wind, and provisions and water cannot be had. In all Tunkin there is not a single harbour where the king's vessels can enter. The islands of Bien-Son and Mee may, however, be useful for building shipping.

The climate of Tunkin is remarkably temperate. Spring takes place in February; summer continues from March to September; autumn takes place in October and November, and December and January form winter, if any part of the year merits that appellation. The rains begin a little before May, and end in August.

Several years ago a dreadful noise, like that of cannon, was heard, and was followed by an irruption of the sea, which advanced more than two leagues into the interior. At the end of twelve or fifteen hours it retired, after having destroyed several villages, and many men and animals. A similar event is said to have taken place fifty years before.

Little is known of the mineralogy of Tunkin. It contains iron and copper veins, Kaolin and Petunze. Gold is found in small particles in the rivers and in the soil. Saltpetre is also found.

The principal animals of Tunkin are the elephant, the buffalo, the rhinoceros, the tiger, the wild bull, wild dogs who go about in troops of one and two hundred, the wild boar, bears of two kinds, one called the horse bear and the other the sow bear, deer, foxes, antelopes, wild cats, rats of a large and voracious kind, which are eaten by the inhabitants, and several poisonous serpents. The coasts and rivers abound with fish and tortoises. The birds are very numerous, among which are eagles and vultures.

The principal production of the soil is rice, which forms the food of three-fourths of the inhabitants. In good land there is a return of forty or fifty for one, and a space of 14,000 square feet is said to have yielded a crop of rice, which, including straw, weighed 6, 8, or 10,000 pounds, poid de marc. The land never lies fallow, but yields two crops annually, one in July and one in November. The one generally remains four months in the ground, but there is a smaller kind which is only a hundred days in it. A leguminous crop is sometimes obtained between the two rice crops. Sometimes only one crop of rice is taken and two leguminous ones, and sometimes the third crop is a sort of black grain called *rung*.

There is a remarkable odoriferous kind of rice which yields arrack by distillation, and is said to intoxicate those who eat it. Herbs and potatoes are also raised, and several other roots unknown in this country. Plums, pomegranates, figs, lemons, and excellent oranges, are raised, and also some of the Indian fruits. Betel, sugar, cinnamon, ginger, pepper, cloves, and tea are also among the productions of Tunkin. The tea is said to be equal to that of China, but this opinion is disputed.

The Tunkinese have arrived at considerable perfection in some of the useful arts. The silk and cotton stuffs are of a very superior quality. The finest cotton stuffs are also manufactured, and the cotton is spun only during the night, when the moisture is supposed to increase the fineness of the threads. These stuffs bring a higher price than those of silk. They have considerable knowledge in dyeing, but they have no soap, the place of which is supplied by the bark of some trees. A whole village is sometimes devoted to the same profession.

Tunkin carries on but little commerce. Rice, and the precious metals, are not allowed to be exported. The exportation of copper and cinnamon is reserved for the emperor. The principal articles of export are fish, walnuts, ebony, ivory, calamine brought from Japan to make brass wire, tortoise shells, molasses, cloth made of bark of trees, very slight carpets, small varnished articles, articles in mother of pearl, cotton and silk, both raw and manufactured. These two last articles of commerce are the most considerable. The articles imported are tea from China, refined sugar, wheat flour, spiceries, medicinal plants, drugs from China and Corea, hemp, lint, silken stuffs, inferior, less durable, and more expensive than those of Tunkin, but in greater demand from their having flowers and patterns, cloth for the uniform of the troops, red cloth for house sandals, mercury, which is not employed as a medicine, but for the solution of metals, large cups and saucers, articles in glass or a kind of paste, jewellery, copper, and iron kitchen utensils. Almost all these articles come from China, but the Europeans exclusively supply Tunkin with instruments of war, particularly fire-arms, which of all articles of merchandise are most in demand. These fire-arms can only be sold to the government.

The vegetable aliments of the Tunkinese are rice, maize, potatoes, but particularly the sea vegetable known in China by the name of Chinchon, and called in Tunkin Hai-tsee. Their animal food consists of beef, buffalo, pork, goat flesh, the rhinoceros, some parts of the elephant, apes, horses, dogs, rats, lizards, worms, and particular kinds of serpents. They do not use milk, and they have the greatest repugnance to blood, and hence they neither eat butter nor cheese. They rear poultry, ducks, and geese, &c. but they prefer the eggs when they are rotten, and particularly when they feel the bones of the embryo chicken crushing under their teeth. They eat the ant's eggs, and fry the nymphæ of the silk worm.

The children go entirely naked till they are seven years old, and when the men are working they wear only a girdle, which returns between their thighs. Their dress of ceremony is a long-sleeved robe, reaching the feet like the robes of office in Europe. Under this robe they have only a girdle. The women wear a robe which leaves naked the upper part of the throat and a great part of their back. Their petticoats come down only to the middle of their leg. Both sexes wear turbans, but neither stockings nor shoes. White is the colour of mournings. Yellow or a golden colour is worn only by the royal family.

The houses consist of three apartments, one for dwelling in, another for the kitchen, &c. and the third for a stable. They must not be square, for this form is reserved for the king, and they must have only one storey, unless the proprietor enjoys some dignity. The houses are almost all made of bamboo.

The constitution of Tunkin is a despotism, and the sovereignty has a nominal dependence on China. The nation is divided into two distinct orders, the princes and the people. The monarchy is hereditary and in the male line, the right of primogeniture being observed. The king, however, can change the order of succession, provided he choose the issue of a solemn marriage. Tunkin is divided into twelve provinces, which are subdivided into arondissements and bailliages, in each of which two mandarins, one military and the other civil, administer justice.

The religion of Tunkin is polytheism. Idols are worshipped, but only as the representatives of living beings. They worship the heavens, the earth, mountains, forests, woods, streams; and their ancestors are worshipped with profound veneration as the guardians of their families. They offer sacrifices to them three times a-year. The bonzes or priests have no spiritual authority, but merely direct the sacrifices, preach and sing to the praises of the divinities.

The whole empire of Tunkin is supposed to contain twenty-three millions of inhabitants.

Tunkin - -	18,000,000
Cochin-China - -	1,500,000
Camboge - -	1,000,000
Siampa - -	650,000
Lac-tho - -	650,000
Total population	21,800,000

The following is the population of the principal towns.

Bac-kinh, the capital, - - - -	40,000
Han-oruts. from 15,000 to - - -	20,000
Tran-hac, from 10,000 to - - - -	15,000
Cau-sang, from 7000 to - - -	8,000
Vihoang - - - - -	6,000
*Hun-nam - - - - -	5,000
Tran Tran-bac Tran-doai } near China, from 4,000 to - -	7,000
Tranhung Tran-vyan Tran-tai } near China, but on the other side, from 5,000 to	6,000
Phu-xuan, the capital of Hue, a province of Upper Cochin-China, and the actual residence of the Emperor of Tunkin, from 20,000 to - -	30,000
Qui-whan Qui-phu } the two capitals of central Cochin China from 8000 to - - -	10,000
Sai-gong, the capital of Lower Cochin China, from 8000 to - - - - -	10,000

For farther information on Tunkin see CAMBODIA, COCHIN-CHINA, LAOS and SIAMPA. See also *Exposé Statistique du Tunkin, de la Cochinchine du Camboge, du Tsiampa, du Laos, du Lac-tho*, par M. M——n, sur la relation de M. de la Bissachere Missionaire dans le Tunkin. 2 vols. Lond. 1811.

TUNNEL, a name given to a subterraneous arch-way driven through a hill or beneath a river, for the purpose of making a canal or a road, or a subterraneous bridge. In our article NAVIGATION, *Inland*, we have already given an account of some of the most celebrated tunnels cut for the purposes of canals. We shall therefore at present limit ourselves to a notice of the new plan of tunnelling invented by that celebrated engineer M. Brunel, and practised in the excavation of the tunnel under the Thames. This notice was drawn up by the editor of this work for a scientific journal.

As the celebrated author of this plan has had the kindness to favour us with a description and drawings of his new method of tunnelling, which, though printed, are, we believe, not intended for separate publication, we conceive that our readers will be highly gratified by an explanation of a method which, in point of ingenuity and utility, has not been surpassed by any of our modern improvements in the useful arts.

The writer of this notice had the peculiar gratification of examining, in 1818, in company with his much respected friend Professor Pictet, all the original drawings, on a large scale, at the house of Mr Brunel, and of having them explained by that distinguished engineer. Mr. Brunel then mentioned that the idea upon which his new plan of tunnelling is founded, was suggested to him by the operations of the *Teredo*, a testaceous worm, covered with a cylindrical shell, which eats its way through the hardest wood, and has, on this account, been called by Linnæus *calamitas navium*. The same happy observation of the wisdom of nature, led our celebrated countryman Mr. Watt to deduce the construction of the *Flexible Water-Main*, from the mechanism of the lobster's tail.

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* The Dutch factory was in this town.

The difficulties (says Mr. Brunel) which have opposed themselves to every attempt that has been hitherto made to execute a tunnel under the bed of a river, have been so many and so formidable, as to have prevented its successful termination in those instances where the attempts have been made.

To propose, therefore, the formation of a tunnel after the abandonment of these several attempts, may appear somewhat presumptuous. On inquiring, however, into the causes of failure, it will be found that the chief difficulty to be overcome lies in the inefficiency of the means hitherto employed in forming the excavation upon a large scale.

In the case of the drift-way made under the Thames at Rotherhithe in 1809, the water presented no obstacle for 930 feet; and, when a great body of quicksand gave way and filled the drift, the miners soon overcame this obstruction, and were able to proceed until they were stopped by a second irruption, which in a few minutes filled it. Nothing comes more satisfactorily in support of the system that is adopted here, than the result of the operations that were carried. under that circumstance, to an extent of 1011 feet, and within 130 feet from the opposite shore.

It is to be remarked that, at the second irruption, on examining the bed of the river, a hole was discovered four feet diameter, nine feet deep, with the sides perpendicular,—a proof that the body of quicksand was not extensive; but what is most remarkable is, that this hole could be stopped merely by *throwing from above clay, partly in bags, and other materials:* and, after pumping the water out under a head of twenty-five feet of loose ground, and thirty feet of water, the miners resumed the work, and proceeded a little further; but finding the hole at the first irruption increased, and the *filling* over the second very much sunk, the undertaking was abandoned.

The character of the plan before us, consists in the mode of effecting the excavation, by removing no more earth than is to be replaced by the body of the tunnel, retaining thereby the surrounding ground in its natural state of density and solidity.

In order so to effect an excavation thirty-four feet in breadth by eighteen feet six inches in height, the author of this plan proposes to have the body of the tunnel preceded by a strong framing of corresponding dimensions, as represented in the accompanying drawings (Plate DXXVI.), and in the model proposed to be submitted for inspection. The object of this framing is to support the ground, not only in front of the tunnel, but at the same time to protect the work of excavation in all directions. The body of the tunnel, which is to be constructed in brick, is intended to be fitted close to the ground, (See Fig. 1-3.); and, in proportion as the framing is moved forward, so the brick work is made to keep pace with it. But, as this framing could not be forced forward all in one body, on account of the friction of its external sides against its surrounding earth, it is composed of eleven perpendicular frames, which admit of being moved singly and independently of each other, in proportion as the ground is worked away in front. These several frames are provided with such mechanism as may be necessary to move them forward, as well as to secure them against the brick-work, when they are stationary. It is to be observed that six alternate frames are stationary, while the five intermediate ones are left free, for the purpose of being moved forward when required; these, in their turn, are made stationary for relieving the six alternate ones, and so on.

In order that a sufficient number of hands may be employed together, and with perfect security, each perpendicular frame is divided into three small chambers, which may properly be denominated cells, (See Fig. 1-2). By this disposition thirty-three men may be brought to operate together with mechanical uniformity, and quite independent of each other. These cells, which are open at the back, present in front, against the ground, a complete shield composed of small boards, which admit of being removed and replaced singly at pleasure.

"It is in these cells that the work of excavation is carried on. There each individual is to operate on the surface opposed to him, as a workman would cut out a recess in a wall for the purpose of letting in a piece of framing; with this difference only, that, instead of working upon the whole surface, he takes out one of the small boards at a time, cuts the ground to the depth of a few inches, and replaces the board before he proceeds to the next. When he has thus gained from three to six inches over the whole surface (an operation which it is expected may be made in all the cells nearly in the same time), the frames are moved forward, and so much of the brick-work added to the body of the tunnel. Thus entrenched and secure, thirty-three men may carry on an excavation which is 630 feet superficial area, in regular order and uniform quantities, with as much facility and safety as if one drift only of 19 feet square was to be opened by one man.

The drift carried under the Thames in 1809, which was about the size of these cells, and was excavated likewise by only one man, proceeded at the rate of from four to ten feet per day. In the plan now proposed, it is not intended that the progress should exceed the rate of three feet per day, because the work should proceed with mechanical uniformity in all the points together.

With regard to the line of operation, if we examine the nature of the ground we have to go through, we observe under the third stratum, which has been found to resist infiltrations, that the substrata, to the depth of 86 feet, are of a nature that present no obstacle to the progress of a tunnel; we are informed that no water was met there. It is therefore through these substrata that it is proposed to penetrate, and to carry the line that is to cross the deep and navigable part of the river, leaving over the crown of the tunnel a head of earth of from twelve to seventeen feet in thickness quite undisturbed, (See Fig. 5.)

Admitting that, in descending to, or ascending from that line, we should come to a body of quicksand, such as that which was found within about 200 feet from the shore, it is then we should find in the combinations of the framing, before described, the means that are necessary for effecting, upon a large scale, what is practised on a very small one, by miners, when they meet with similar obstacles. Indeed, were it not for the means of security that are resorted to on many occasions, mines would inevitably be overwhelmed and lost.

Although we may encounter obstacles that may retard the daily progress of the work, it is with satisfaction we contemplate that every step we take tends to the performance and ultimate completion of the object; and, if we consider that the body of the tunnel must exceed the length of Waterloo Bridge, it must be admitted that, if instead of two years, three were necessary to complete the undertaking, it would still prove to be the most economical plan practicable for opening a land communication across a navigable river.

In order to execute the tunnel beneath the Thames by the method described in the preceding paper, it is proposed to raise a capital of £160,000, by transferable shares of £100 each. The following are the heads of expense:

Preparatory expenses, - - -	£9,000
Expenses of the execution of the work, which will require two years, -	24,000
Expense of materials, - - -	87,000
Purchase of ground, - - -	20,000
Unforeseen expenses, - - -	24,000
Total, -	£166,000
Value of steam engine, &c. - -	6,000
	£160,000

Our readers are already acquainted with the great disasters which have obstructed the completion of this great undertaking; disasters which affect neither the judgment nor the foresight of the engineer, but which arose from circumstances which could neither be foreseen nor prevented. It could scarcely have been expected that private enterprise would again be embarked in this national work; but we anxiously hope that in better times this will be the first national work on which the public capital will be expended. The minister who lends his aid to its completion will acquire a reputation which no other public measure could confer upon him.

TUNNY Fishery. See France, Vol. IX. p. 437.

TURBOT. See Ichthyology, Vol. XI.

TURENNE, Henry de la Tour, *Viscount of*, a celebrated general, was the son of the Duke of Bouillon, by Elizabeth, daughter of William I. Prince of Orange. He was born at Sedan in 1611. He was killed on the 27th July, 1675, while reconnoitring a fit place for a battery. An account of his military life has already been given in sufficient detail in our article France, Vol. IX. p. 316—320. See also Ramsay's *Life of Marshal Turenne.*

TURGOT Anne,—Robert Jacques, a celebrated minister and political economist, was born at Paris in 1727. He was educated for the church, and in the 22d year of his age he delivered two discourses in Latin, one on the "Progress of the Understanding," and the other "On the advantages derived to Mankind from the Christian Religion." In 1751 he translated the Georgics of Virgil, and about this time he began to devote himself to the study of political economy. Upon quitting the Sorbonne, he was appointed Intendant of Limoges, a situation which he filled with the highest credit for twelve years. In 1775, he was appointed Comptroller General of Finance, a situation in which he made many great reforms; but as he did not possess the public confidence, he was obliged to resign, and was succeeded by M. Neckar. In order to stimulate his industry, he was in the habit of stating that, in his family, life was not protracted beyond 50, and he completed all his undertakings in reference to this event. He died in 1781, at the age of 49, thus carrying on what seemed to be the destiny of his family. In our article France, Vol. IX. p. 334, we have given an account of his labours as Comptroller General of Finance, and we must refer the reader for further information respecting his life and character to the Marquis Condorcet's "*Memoirs of the Life and Writings of Turgot*," 1782, 8vo.

TURIN, a large city of Italy, and capital of the kingdom of Sardinia. It is situated on a fine plain on the western banks of the Po, at the conflux of that river with the Grand Doria, and about seven miles from the foot of the Cottian Alps. The approach to the town is magnificent, through a beautiful country, filled with villas and gardens. The town is of an oblong form, and is about four miles in circuit, including the ramparts. The streets in the new town are wide, clean, and straight, running generally in direct lines, and intersecting one another at right angles, so as to divide the town into 145 parts or squares. Arcades or piazzas are common in many of them. The houses are of brick stuccoed, and the streets often terminate with some agreeable object. The best streets are the Strada di Po, extending to the river from the great central square, the Contrada di Dora Grande, extending 500 fathoms in length, from that same square in the opposite direction, the Via Nuova, and the Sta Theresa. The principal or central square, called the Piazza Reale, is one of the finest in Europe. In the centre is the Castello Reale, built by the Duke of Savoy; on one side is the Royal Palace, containing splendid furniture and fine paintings, and the other three sides are occupied with houses having arcades. The Piazza de St. Carlo is on a smaller scale, but preferred by some as handsomer than the Piazza Reale. The facades are uniform, and its two larger sides have arcades supported by pillars. There are other eight squares in the town. The old town of Turin forms only a sixth of the city, but the streets, though narrow and less elegant than those of the new town, are in general straight and contain many good houses. The cathedral is an old Gothic building, with a marble cupola, and with several valuable articles in its treasury. The church of St. Suaire is the finest in the town; that of St. Laurent is celebrated for its bold cupola. The church of St. Croix has a fine rotunda. The church of St. Philippe de Neri is very beautiful. That of St. Cristine contains the fine statue of St. Therese, a *chef d'ouvre* of Legros. In the church of St. Therese, the chapel of St. Joseph is ornamented with the fine pictures of Corrado. The other churches are those of the Visitation and Conception, Consolata, St. Salvadore, and Corpus Domini, which is the most highly ornamented of them all. There are in all 110 churches and chapels. The royal palace, already mentioned, is a brick building of great extent, covered with tiles, and consists of three wings surrounded with a court. The Castello Reale has a handsome front of the Corinthian order, while the other three sides are Gothic. The buildings of the academy and university occupy the four sides of a square, surrounded with arcades, the whole of which are covered with inscriptions and basso-relievos. The opera house, or principal theatre, is a large building, and the largest in Italy. The arsenal, besides armories, and workshops for the manufacture of fire-arms, has a chemical laboratory, a cabinet of minerals, a library of metallurgical and mineralogical books, and furnaces for casting cannon. There are also teachers in it who instruct engineers, miners, &c. in their respective professions. The Royal Hospital of Charity is on the plan of a celebrated one at Rome, where employment is found for its inmates and education for the children. The Palazzo Carignani is a building of importance and even elegance, though its facade is only of brick. The barracks were regarded as among the finest in Europe. When the French occupied Turin in 1778, they destroyed the fine city gates, which were handsome. The citadel and other fortifications were also destroyed.

The Royal Academy of Turin has long held a high place among the learned societies of Europe, and continues to publish very valuable volumes of transactions, a particular account of which has been given in our article ACADEMY, Vol. I. p. 69. It is particularly celebrated as having given to the world some of the finest productions of La Grange.* There is also at Turin, a school for educating young men of rank, a lyceum, an institution for educating clergymen, and agricultural and veterinary schools. The University, instituted in the beginning of the fifteenth century, was endowed for twenty-four professors, but it has been subsequently greatly extended. It has a museum, library, collections of statues, medals and vases, an observatory, and an anatomical theatre. Two schools, both of which are well attended, are dependant on the University.

The manufactures of Turin consist of woollen, cotton, and silk fabrics, damasks and velvets. Leather, stone-ware, liqueurs, works in marble, wood and wax, are also made here. The paper mills are on a large scale, and the government has a manufactory of saltpetre and gunpowder, and another of tobacco and snuff. The Po, which is navigable, facilitates greatly the trade of the place. The public walks are the Royal Gardens, the morning resort of the gay, the terrace on the other side of the river, the Rondo between the walls of the banks of the Po used as an evening rendezvous, and the Valentino. The Corso contains all the fashionable world in their carriages between 5 and 6 in the evening.

The environs of Turin are beautiful. About a mile beyond the eastern ramparts is the ancient place called the Queen's Chateau, situated at the base of a hill; the ascent to which is adorned with the villas and gardens of the wealthier inhabitants. At some distance from the city is the church of La Superga, a large and noble building, erected in memory of the defeat of the French in 1706. The Royal Mausoleum, containing the tombs of the kings of Sardinia, occupies the subterraneous portion of this building. From the summit of its cupola may be seen the whole plain and the mountains of Piedmont. In fine weather the view extends even to Milan.

The mountain of the Capuchins is resorted to for a view of the city, and of the beds of the Po and the Doria. The other objects of notice in the vicinity of Turin, are the Chateau of Shipiniggi, the church of St. Sauveur; the Venerie, once the chief country house of the king; the celebrated oak, half way between Turin and Venerie, beneath which a council of war resolved upon the attack of the French lines in 1706; Moncalderi on the Po, and the ruins of the ancient town of Industria, six leagues from Turin, in the direction of Verceil.

Turin is a place of great antiquity. Hannibal sacked the town which then occupied its present site, because the inhabitants refused to join his standard. It was afterwards rebuilt, and was called by Cæsar *Colonia Julia*, a name which his successor changed into *Augusta Taurinorum*.

The population of Turin in 1816 was 38,500, and in 1820 it was 90,000. East Lon. 7° 40′ 15″, Lat. 45° 4′ 6″.

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* A fuller account of this Academy will be found in our Life of M. De la GRANGE.

TURKEY.

Turkey, an extensive empire which comprehends some of the richest portions of Asia, Africa, and Europe, extends nearly 35° from east to west, and above 20° from north to south, and embraces within its limits various separate states, having each its own political and natural boundaries, and differing from each other in laws, language, customs, and religion.

As the modern divisions of this empire, established by the Turks, are altogether artificial, and ill adapted for geographical purposes, it has been considered expedient to adhere to its ancient divisions in the progress of this work, and we consequently refer our readers to the articles in the following table.

Moldavia,
Wallachia,
Bulgaria,
Servia,
Bosnia,
Croatia,
Dalmatia,
Albania,
Epirus,
Romania,
Macedonia,
Thessaly,
Morea,
Candia,
Natolia,
Caramania,
Armenia,
Georgia,
Curdistan,
Diarbekir,
Syria,
Palestine,
Cyprus,
Egypt.

It may, however, be proper to exhibit tables of its modern divisions and population, which we have abridged from M. Malte Brun's Universal Geography.

TURKEY IN EUROPE.

I. Ejalet Roumili (*Country of the Romans.*)

Sangiacs.	*Ancient Divisions.*
Istambol.	Constantinople.
Edrenih.	Adrianople.
Wisa.	Romania or Thrace.
Kirkkissa.	
Tschilmen.	
Silistra.	Bulgaria and part of Thrace.
Nicopoli.	
Widin.	
Sofia.	
Kostendil.	Macedonia.
Uskub.	
Salonik.	
Ochrida.	
Tirhala.	Thessaly.
Janina.	Epirus.
Delonia.	
Aulona.	
Ilbessan.	Albania.
Iskendria.	
Dukagin.	
Perserin.	
Veldschterin.	Servia.
Aladschahissar.	
Semendra.	

II. Ejalet Bosna (*Country of Bosnia.*)

Sangiacs.	*Ancient Divisions.*
Banyaluka.	Croatia.
Trawnik.	Bosnia.
Srebernik.	
Iswornik.	
Jenibazar,	Rascia.
Hersek.	Dalmatia.

III. Ejalet Morah (*Country of the Morea.*)

Tripolitza.	Peloponnesus.
Mistra.	Laconia and Messenia.

IV. Ejalet Dschesair (*Country of the Islands and Coasts.*)

Galliboli.	Southern Thrace.
Egribos.	Beotia, &c.
Ainabacht.	Western Hellade.
Midillii.	Mitylene.
Andra.	Northern Cyclades.
Nakscha.	Southern Cyclades.

V. Ejalet Kirid (*Country of Crete.*)

Candia.	Crete.
Retimo.	
Kanea.	

Intermediate Provinces.

Moldavia.	Part of Dacia.
Wallachia.	

Population of European Turkey, according to M. Hassel, (1823.)

Provinces.	German sq. mls.	Greeks.	Turks.	Other Nations.	Total.
Roumili,	4,776	1,640,000	1,806,000	2,097,000	5,543,000
Bosna,	1,062		157,000	303,800	560,000
Morah,	402	710,000	50,000	30,000	790,000
Dschesair,	1,079	600,000	200,000	107,000	907,000
Kirid,	188	141,000	124,000	4,400	270,000
Wallachia & Moldavia,	2,100		5,000	1,395,000	1,400,000
	9,607	3,091,000	2,342,000	3,936,400	9,510,000

Population according to the different nations.

Primitive Inhabitants.		*Foreigners.*	
Greeks,	3,090,000	Turks,	2,350,000
Slavonians,	1,440,000	Tartars,	275,000
Albanians,	460,000	Abadiotes,	4,000
Wallachians,	1,375,000	Armenians,	85,000
		Jews,	312,000
	6,365,000	Gypsies,	80,000
Foreigners,	3,111,000	Franks,	5,000
	3,254,000		3,111,000

Population according to the different worships.

Mussulmans,	2,889,000
Greek Christians,	5,880,000

Catholics,	310,000
Armenians,	85,000
Jews,	312,000

TURKEY IN ASIA.

Asia Minor, with the Coasts of the Black Sea.

Pachalic of Anadhouly.

Sandgiacats.	*Chief Towns.*
Kutaiah.	Kutaiah (Cotyæum.)
Sarou-Khan.	Magnisa (Magnesia.)
Aidin.	Tireh.
Mentesche.	Mullah.
Tekieh.	Antaliah.
Hamid.	Isparteh.
Karahissar,	Karahissar.
Sultan Eugny.	Eskishehr (Dorylæum.)
Angouri.	Angouri (Ancyra.)
Kiangari.	Kiangari.
Kastamooni.	Kastamooni.
Boli.	Boli (Claudiopolis.)
Khudavendkiar.	Broussah (Prusa.)
Karassi.	Balikesri.
Kodja-Ili.	Isnikmid (Nicomedia.)
Bigah.	Bigah.
Sogla.	Ismir (Smyrna.)

Pachalic of Siwas.

Siwas.	Siwas.
Djanick.	Samsoun.
Arebkir.	Arebkir.
Diwriki.	Diwriki.
Tchouroum.	Tchouroum.
Amassiah.	Amassiah.
Bouzok.	Jeuzgatt.

Pachalic of Tarabozan.

Tarabozan.	Tarabozan (Trapezus.)
Gounieh.	Gounieh (Absarus.)
Batoomi.	Batoomi.

Pachalic of Konich.

Konieh.	Konieh (Iconium.)
Nighdé.	Nighdé.
Beysheri.	Beysheri.
Akshehr.	Akshehr (Tyriæum.)
Akserai.	Akserai.
Kaisarieh.	Kaisarieh (Cæsarea.)
Kirshehr.	Kirshehr (Archelais.)

Pachalic of Merasche.

Merash.	Merash.
Kars.	Kars Zoulkadry.
Aintab.	Aintab.
Someisath.	Someisath (Samosata.)
Malatiiah.	Malitiiah (Melatene.)

Pachalic of Adana.

Adana.	Adana (Antiochia.)
Tarsous	Tarsous (Tarsus.)

Mousselimlik of Cyprus.

Island of Cyprus.	Lefcosiah.
Itchil.	Selefkeh (Seleucia.)
Alanieh.	Alanieh (Side.)

ARMENIA, MESOPOTAMIA, AND ILAC ARABI.

Pachalics.	*Chief Towns.*
Kars.	Kars.
Erzroom.	Erzroom (Arze.)
Van.	Van (Iban.)
Diarbekir.	Diarbekir (Amida.)

Sandgiacats.	*Chief Towns.*
Orfa.	Orfa (Edessa.)
Mosul.	Mosul (Labbana.)
Koordistan.	Bedlis.
Bagdat.	Bagdat.

SYRIA AND PALESTINE.

Aleppo.	Aleppo.
Tripoli.	Tripoli.
Saide or Acre.	Saide.
Damascus.	Famieh (Apamea.)

"It would be vain," says M. Malte Brun, "to expect a near approximation to the truth in any conjectures which we might indulge respecting the population of a state in which registers and a regular census are unknown. Some writers estimate that of European Turkey at twenty-two, while others have reduced it to eight millions, and both assign equally plausible grounds for their opinion. Respecting Asiatic Turkey, the uncertainty, if not still greater, is at least more generally acknowledged. Supposing the houses to be as thinly scattered as in the less populous parts of Spain, the population of all Turkey in Europe, Asia, and Africa, may amount to twenty-five or thirty millions, of which one-half belongs to Asia. Under the want of any thing like positive evidence, we shall not deviate far from probability in allowing to Anatolia five millions; to Armenia two; to Koordistan one; to the pachalics of Bagdat, Mosul, and Diarbekir one and a half; and to Syria 1,800,000, or at most two millions."

The Turks can scarcely be said to have a country. Since their first establishment in Europe until the present day, they have never almost in any degree intermixed with the nations which they overcame; but have continued a distinct and separate people, oppressing their vanquished subjects with cruelty and scorn, and regarding them as a degraded class, unworthy of exchanging with their conquerors the civilities of social life. Except in Asia Minor and in Constantinople, the Turks throughout this extensive empire can be regarded only as military colonists. They form the garrisons in the fortresses, or live on their incomes or pay from the government, or on the money which they are continually extorting by force from the unhappy unbelievers. Thus while the other nations of Europe have been gradually advancing in civilization, in science, and in letters, this people, wrapped up in their own self-sufficiency, despise every improvement that does not minister to their arrogance and sensuality.

The government of the Turks is a pure despotism. Both the executive and legislative authorities essentially reside in the sovereign. His spiritual rule, as successor of the caliphs, is implied by the title of *Imamul-musliminn* (pontiff of Mussulmans), and *Padishah Islam* (emperor of Islamism) indicates his temporal power. He is the sole fountain of honour, for here birth confers no privilege. He raises and debases whom he wills, and disposes of the lives and properties of his subjects. His actions are regarded as prescribed by inevitable fate; and his subjects suffer with resignation, believing that they have neither right nor reason to complain. Indeed it is esteemed an honour, and a passport to paradise, to die by his hand; and some of his ministers are said to have courted this martyrdom as the last reward of their faithful services. The Turkish casuists declare, that the sultan is above the law, and attribute to him a character of holiness which no immoral conduct can destroy. This power is supposed to be balanced in some degree by that of the grand mufti and ulema; but, as Baron de Tott observes, though they can interpret the law as they please, and animate the people against their sovereign, he, on the other hand, can with a single word depose and banish the mufti, with as many of the ulema as may fall under his displeasure. The restraints of law and custom form but a feeble barrier against the sallies of passion, pride, and selfishness, supported by unlimited power; and hence the sultan is styled by his subjects *yoularsiz arslan*, "the unmuzzled lion." The only effectual check to tyrannical conduct on the part of the sultan is the mob of Constantinople, who freely vent their complaints. Individual petitions are presented to the sultan while on his way to the mosque, where he goes every Friday; but when the complaint is of a general nature, the popular discontent is shown by setting fire to different parts of the city. The sovereign is obliged to appear in person to assist in extinguishing the flames, and then he is compelled to listen to the public voice, and to hear truths which none of his ministers had dared to breathe. These tumultuous movements, however, seldom stop with the redress of grievances, but are not unfrequently followed by the deposition or execution of the monarch himself. Hence it is a great object of the government to keep the capital and other great cities in good humour; and consequently the price of provisions is always kept at a low rate within their walls, though the provinces should starve to furnish the supply.

The evils of absolute power are aggravated in this country by the ignorance and effeminacy of those who are called to exercise it. The princes of the blood are, from their infancy, confined in the *Cafesse*, a palace in the seraglio, attended by only four or five eunuchs as their pages, and a few female slaves old enough not to become mothers. Sequestered from general society, they are kept in complete ignorance of what is passing in the empire. With minds uncultivated by education, and bodies enervated by idleness and indulgence, they are little prepared for the important and difficult duties which may await them; and consequently, when they are called to the throne, they often abandon the affairs of state to the mercy of their eunuchs and flatterers, who are equally ignorant of the art of governing as their master. Perhaps a favourite page, a black eunuch, rendered hideous by his physical impotence, becomes the dispenser of the dignities of the empire, and, by a word, appoints and changes the first officers of the state. When a sovereign of this country, therefore, at any time rises superior to the difficulties of his situation, and, in spite of a neglected and degraded education, directs with energy and discretion the resources of the state, he must be possessed of no common talents.

Under the sultan, the civil or temporal government of Turkey is carried on by the vizier and other principal ministers, who form the divan or great council of state, which, on solemn occasions, is called upon to direct the sovereign by their advice; when the sultan witnesses their deliberations, but is separated from them by a curtain or latticed window. The members of this body are, the grand vizier, the *capudan pacha* or lord high admiral, the two *cazy-askers* or military judges, the grand treasurer of the empire, the second treasurer, chief of the war department, the grand purveyor, and the *nishandji effendi*, who affixes the cypher of the grand signior to public acts.

The grand vizier is the vice-regent of the sultan, and has the charge of the imperial seal. All the affairs of the empire come under his inspection. To him the grand admirals and pachas address their official reports. He is the supreme judge in civil and criminal affairs, from whose sentence there is no appeal; and he commands the army in time of war. But his responsibility is in proportion to his power. As his most important duty is to keep the empire and capital quiet, he is held accountable for all the misfortunes which befal the state; and in scarcities, defeats, or any other calamity, the resentment of the people is directed in the first instance against the person and administration of the grand vizier. Such are the dangers to which this minister is exposed, that he rarely escapes confiscation and exile, or a sudden death.[*]

The other officers of state are, the minister of the interior, who bears the title of *kethkudai sadri aly*, the *reis-efendy*, or minister of foreign affairs, the *defter-dari-chikki-evvel* or minister of finance, the *capudan pacha* or grand admiral, and others of inferior importance. They all remain during the day at the vizier's palace, and superintend the affairs of their several departments.

The government of the provinces is intrusted to *pachas* or *viziers*, *beys* and *agas*. The pachas are distinguished, after a Tartar custom, by three horse tails on the side of their tents, and receive by courtesy the appellation of *beyler beg* or prince of princes; but this title, by way of eminence, belongs only to the pachas of Romelia, Anatolia, and Damascus. The next in rank are, the pachas of two tails, the beys who are honoured with one tail, and the agas or military governors, who have only the *sanjac* or standard. There are also *vaivodaliks*, which are in general small districts, or single cities or towns separate from the greater governments, as being in most instances the appanage of a sultana, or of a great officer of state. Though unequal in dignity, every governor represents the sultan within the limits of his own jurisdiction, and is accountable to him alone. The revenue, the administration of justice, and the military force of the province, are intrusted to his hands; and he exercises these prerogatives in all their fullness. With all their power, however, they are, to use a Turkish phrase, but "statues of glass," which a single blow from their master may dash in pieces in a moment. As they owe their appointment to his favour alone, they are deposed and punished without the liberty of complaint or remonstrance; and at their death their accumulated wealth goes into the coffers of the state. "It is a fact," says Mr. Thornton, "of public notoriety, that governments of every description are sold at the Porte; they are held for the term of one year only, and at the ensuing *Bairam* the leases must be renewed, or transferred to a less parsimonious competitor. In the public registers, the precise value of every important post under government is recorded; and the regular remittance of the taxes and tribute is the only acknowledged criterion of upright administration.

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[*] Rycaut mentions a prime vizier, who put the following question to certain pachas; and which was considered a problem of rather difficult solution. "What courses were possible to be found out for a first vizier to maintain and continue his office, and acquit this so dangerous charge, from the hazard and uncertainty to which it is liable; for you see, brothers, said he, how few enjoy or grow old therein; their virtue, their care, and their innocence, are no protection; some remain a day, a week, a month; others protract the thread to a year or two, but at length they are like the ant, to whom God gives wings for their speedier destruction.

The theocratical or spiritual branch of the Ottoman constitution is exercised by the *ulema*. The members of this body form a distinct class in the community; and consist of the doctors of law, the judges, and the ministers of religion. The *Soutahs* or clerical students, from among whom all the ulemas must be taken, receive their education at the *Medresses* or religious schools annexed to the imperial mosques. They are chiefly from Syria and Asia-Minor, and are very numerous. Constantinople alone contains above ten thousand of them, who are declared to be the most savage, the most fanatical, the most turbulent, and the worst subjects among the Turks. When these students have acquired a sufficient stock of learning, and have attained the proper age, they are permitted to devote themselves either to the interpretation of the laws, the administration of justice, or the ministry of religion. The officiating ministers of religion form the lowest class, and require the fewest years of study. Their duty is confined to the ceremonies of public worship and the services of the mosques, from whose revenues they are maintained. This class, however, can scarcely be said to belong to the ulema in the restricted acceptation of the word; and are even arranged under a separate jurisdiction, being subordinate to the civil magistrate, who has the privilege of suspending and removing those whose conduct is reproachable, and who are unequal to the dignified discharge of the duties of their office. In the larger mosques there are *sheiks* or preachers, *kiatibs* or readers; *imams*, who recite the prayers, *muezzins* or criers; and *cayyims* or sextons. In villages or small parishes, the imam performs the whole duty, and also acts as the *hogia* or schoolmaster. Besides these regular officiating ministers there are several orders of *dervises*, who are held in great veneration by the vulgar; but most of whom are immoral and profane characters. Of these there are thirty-six distinct orders in the Ottoman empire. "They wear a very sorry habit," says M. Corneille le Bruyn, "with a large high crowned hat upon their head, lead a sort of monastic life, and affect to pass for santos or saints; though, to speak the truth, they are loose souls, notorious hypocrites, and commonly great drunkards."

The next in order of rank to the ministers of religion are the *mehhkeme kiatibi*, or clerks of tribunals; *naibs*, or substitutes of the judges; *cadis*, or judges of the lesser towns; *mollahs*, or judges of the principal towns or cities; *the istambol effendi*, or master of police at Constantinople; the two *cazy-askers*, or supreme judges of Romelia and Anatolia; and the highest in dignity is the grand *Mufti*, who is also called *sheikislam*, prelate of orthodoxy. The ceremony of girding on the sabre of a new sovereign, which answers to our coronation, is performed by the mufti; and he alone has the honour of kissing the sultan's left shoulder.

The ulema are endowed with peculiar privileges. They are exempted from all taxes. Their property is hereditary in their families; and not liable to confiscation like that of other subjects. They hold the *fetva* or holy seal, which the ancient caliphs used to affix to their acts; and when the sultan wishes to have the sanction of religion to any matter of great importance, he must obtain their consent. Neither the fetva, however, nor the opinion of the mufti are indispensable in any case; and this dignitary is generally consulted on the affairs of state more as a matter of form than any obligation imposed on the monarch. The sanction of the ulema, however, to public measures is sometimes of consequence, as it secures to them more implicit respect from the people, and removes from the sovereign and his ministers all responsibility as to the consequences. In fact, the prince can command the consent of the mufti to any measure. His continuance in office depends upon the will of the sultan, who can remove him by a nod, and raise up in his place a more obsequious successor. The great power of the ulema rests in their influence with the people; and they have sometimes been used by the heads of faction to stir up rebellion, and direct public opinion against the throne. All the revolts of the janissaries are attributed to them; and to their intrigues, it is said, all the dethroned sultans owed their misfortunes.

The laws of this country, both civil and criminal, are founded upon the precepts of the Koran; the example and opinions of Mahomet; the precepts of the first four caliphs; and the decisions of the learned doctors upon disputed cases; and they are of different degrees of obligation according to the authority from which they are derived. These are digested in one large volume under the title of *Multeka*, and form the universal code of the empire. From the obscurity, however, and ambiguity of many of its injunctions, much is left to the discretion of the judges; and as there is no appeal from their decisions, they give themselves little trouble about the niceties of evidence or formality of precedent. Their mode of administering justice is indeed sufficiently simple and expeditious.

but leading to continual injustice from their ignorance and cupidity. Every district in Constantinople has its *mehhkemé* or tribunal, where the *cadi*, assisted by his *naib*, hears and determines all cases civil, criminal, and ecclesiastical. In civil matters each party pleads his own cause, and supports his statement by two witnesses. The decision is prompt and final; but it depends more upon the previous bribe than the justice of the case. This venality in the judges forms a common subject of satire among the people. "It is difficult to do justice," said one cadi to another, "when one of the parties is rich and the other poor." "No," replied his colleague, "I find no difficulty in that case, for then I decide of course for the rich; the only difficulty is when both are rich, for then I do not know on which side to incline." To Christians the evils of corruption are aggravated by a swarm of false witnesses who continually infest the courts of justice. This infamous profession is openly avowed and even encouraged, as perjury against a Christian is considered a very venial offence. These informers obtain a regular livelihood by instituting vexatious suits, and extorting money by means of false oaths. As the successful party pays the costs of suit, the Christian, though proved to be right, must be a loser; and hence many enter into a compromise with the informer rather than risk the uncertainty of the law.

Criminal jurisprudence can scarcely be said to have any existence in this country. Punishment almost immediately follows the accusation; and is executed without reflection, and often under the influence of passion. The grand vizier, who is chief of the police in the capital, frequently explores the streets *incognito*, surrounded by some of his officers, and attended by a train of executioners. Seldom is his course unmarked with blood. When any one, by an inconsiderate step, excites his displeasure, he waves his hand to his officers, and while he continues his way, the unfortunate man falls under the stroke of the executioner. "A man caught in the act of pilfering property during a fire, has been thrown into the flames by order of the vizier. A house-breaker, detected in robbery, is hanged up without process, at the door of the house which he robbed. Shop-keepers, or dealers, convicted of using false weights or measures, are fined, bastinadoed, or nailed by the ear to their own door-posts." Prince Repnin one day complained to the vizier against some soldiers who had insulted the gentlemen of the Russian embassy, the vizier made a horizontal motion with his hand, and before the conference was ended, seven heads were rolled from a sack at the prince's feet.

In the provinces the same system prevails with perhaps less regard for human life and individual happiness. Indeed, Turkish jurisprudence, in all its branches, is little removed from what it might be supposed to have existed in the camp of Othman.

The religion of the Turks is Islamism in its most intolerable form. Acting upon the principle of exclusion inculcated in the Koran, they regard with disdain and aversion all who are strangers to their faith. The radical doctrines of the Koran are sufficiently simple, and many of its precepts are unexceptionable; but these are mixed up with such absurdities and follies, as to retain its adherents in a state of ignorance and barbarism. By inculcating a contempt for profane knowledge, and prohibiting all communication with infidels or idolaters, which are the terms applied to all other sects, an insurmountable barrier is raised against all improvement in the sciences and arts. Some of the more learned, indeed, of whom there are but very few, hesitate in giving full credence to the miracles of the Koran; but they dare not publicly contradict the national prejudices. An effendi, skilled in mathematics, being asked how he could believe that Mahomet broke the star of the moon and caught half of it, as it fell from heaven, in his sleeve? He replied "that it was not only not agreeable, but contrary to the course of nature; but that as the Koran affirmed the truth of the miracle, he could not refuse it his assent; for," added he, "God can do whatever he pleases." The Mahometan creed may be said to consist only of two articles; *that there is but one God, and Mahomet is his prophet.* A firm conviction of this; and the practice of a few external ceremonies, constitute a true believer, entitling him to the joys of heaven. They believe also in the existence of purgatory (*araf*) in which they say the negligent and vicious believer must expiate his crimes, and repeat the prayers which he omitted in this life. But they affirm that every believer, whatever may have been his deeds, will be at length admitted into paradise. The outward observances enjoined in the Koran, are circumcision, prayers, oblations, fastings, and a pilgrimage to the Caaba of Mecca. *Circumcision* differs from that of the Jews, both in its form, and the age at which it is administered. The young believer must have reached his seventh year, and be able to understand the confession of his faith: that there is one God and Mahomet is his prophet. Prayers (*namaz*) are enjoined to be offered five times a day; before sunrise, at noon, at four in the afternoon, at sunset, and before midnight, and these in their order are instituted in honour of Adam, Abram, Jonas, Jesus, and Moses. The worshippers are summoned to their devotions by the *muezzin*, who proclaims with a loud voice from the highest towers of the mosque the hour and the duty of prayer. But prayer is not considered acceptable to the Deity unless preceded by *ablutions*. These are four in number, namely, *Amam*, extraordinary bathing; *Taharat*, or cleanliness, designed for the necessities of the body; *Abdest*, which is enjoined for clearing away all pollutions from the five organs of sense; and *Ghoussoul*, or purification, which is simply dipping themselves three times in water. These ablutions are considered a necessary preparation to acceptable worship, as any impurity upon the person or clothes would invalidate the virtue of prayer. The great *fast* among the Turks is the *Ramazan*. It lasts a whole month, during which they abstain from all food or drink, or any gratification of the senses while the sun remains above the horizon. At sunset they flock to the streets and the coffee-houses, where they indulge themselves during the night;

and, at the first appearance of dawn, they hasten home and sleep away the day. The Ramazan is immediately followed by the great *Bairam*, or Easter, which consists of three days of public rejoicings. There are also the lesser Bairam, and several others of minor importance. The *Hadj* or pilgrimage to Mecca, is enjoined upon all Mussulmans, and is considered so meritorious an act of devotion as to cancel the sins of a whole life. Those who have kissed the Black Stone, which is the chief object of the pilgrim, receive the appellation of *Hagi*, and are distinguished by the respect and veneration of their fellow-believers.

The Turks are generally a well-formed and robust race of men, of a handsome and noble physiognomy, with a tawny complexion, and black or dark brown hair. The natural gravity of their deportment suits well with their bulky turban and large flowing robes, which sit easily and gracefully upon them, either when walking or reclining upon their couches. The form of the turban serves to characterize the public functionaries, and the different classes of the nation. In the capital and European provinces, the turban is commonly made of white muslin; while the Arabs and Asiatics employ linen cloth either dyed or variegated. The descendants of Fatima, the daughter of Mahomet, are exclusively distinguished by a green turban. The Turks shave the head, but retain the beard as a symbol of manhood; and are extremely proud of their mustaches. They never remove their turbans but when they go to repose; and they take off their slippers whenever they enter a mosque, or the house of a great man. Dress is a predominant passion among the people. "An Ottoman minister would be capable of betraying the interests of the empire for a sable pelisse. An Ottoman of the lower class would sell his honour and his most sacred duties for a scarlet caftan. It is true that their coxcomb youths make no use of cosmetic toilets, and all that which constitutes the science of their European brethren; but their wardrobe is so costly that a beau in a turban would buy with his single Cashmir sash, the entire wardrobe of his brother beau in a hat and coat,who flutters in the saloons of London or Paris."

The general character of this people partakes of the nature of their government and religion. The arrogant dictates of Islamism generate in the minds of its votaries a supercilious contempt and even hatred against all who are of a different persuasion; hence they are proud, morose, ferocious, austere and intolerant in their intercourse with strangers; while the oppressions of their government render them fawning, deceitful, sordid and selfish. It is difficult, however, to ascertain the true character of the people. There never has been any cordial and familiar intercourse between them and any Christian nation. "An European," says a late writer, "may reside for years in the great eastern capital without knowing ought of the Turkish domestic economy, or understanding one jot of the origin of their customs, the true state of their manners, or the right tendency of their institutions." Hence the discrepancies among travellers upon this point. By some the Turks are held up as patterns for our imitation; by others they are reprobated as objects of abhorrence. We are told, by a writer in the Foreign Review, a Fanariot Greek, who held the office of secretary interpreter to the Porte, that "their portion is settled ignorance, and unqualified, unredeemed barbarity;" "but their character is not uniform. It varies considerably in the different provinces, and also in the villages and towns. The Turk of Bulgaria is rude to ferocity; of Thrace, haughty and fanatic; the Macedonian is covetous and distrustful; the Thessalian, wicked and cowardly; the Albanian, murderous, thievish, and insatiable; the Bosniade, inhospitable, savage, and blood-thirsty. The Turk of the commercial towns is rapacious and perjured; the Turk of Asia Minor is rendered ferocious by fanaticism, and by destitution in the interior provinces; insolent, a spoliator and a tyrant in the maritime districts. The Turk of Constantinople, not only to show his dissatisfaction at the abuses of government, but also to plunder the houses and shops of individuals, sets them on fire, and commits most frightful acts of barbarity." Dr. Clarke, on the other hand, affirms, "there are many virtues common to the Turks which would do honour to any nation; and above all, that reverence for the Deity, which renders the taking of his name in vain to be a thing unheard of among them: add to this, their private and their public charities; their general temperance and sobriety; their donations for the repose and refreshment of travellers, and for the establishment of public baths and fountains; their endowment of hospitals; their compassion for animals; the strict fidelity with which they fulfil their engagements; their hospitality; the attention shown to cleanliness in their frequent ablutions; and many other of their characteristics, which forcibly contrast them with their neighbours; and we shall be constrained to allow that there can hardly be found a people, without the pale of Christianity, better disposed towards its most essential precepts." He adds, however, "That they have qualities which least deserve our approbation; and that these are the most predominant must be attributed entirely to the want of that "leaven," which in "leavening the whole mass," hath not yet extended its influence to this benighted people." Mr. Thornton, who was long resident among them, and to whose work we are indebted for much of this article, describes the Turkish character as a "composition of contradictory qualities. We find them brave and pusillanimous; gentle and ferocious; resolute and inconstant; active and indolent; passing from devotion to obscenity, from the rigour of morality to the grossness of sense; at once delicate and coarse; fastidiously abstemious, and indiscriminately indulgent. The great are alternately haughty and humble; arrogant and cringing; liberal and sordid; and in general it must be confessed, that the qualities which least deserve our approbation are the most predominant. On comparing their limited acquirements with the learning of the Christian nations of Europe, we are surprised at their ignorance; but we must allow that they have just and clear ideas of whatever falls within the contracted sphere of their observation." "The Turk," says the same author, "is usually placid, hypochondriac and unimpassioned; but when the customary sedateness of his temper is ruffled, he seems possessed with all the ungovernable fury of a multitude; and all ties, all attachments, all natural and moral obligations are forgotten and despised till his rage subsides." It is in the middle ranks of society that a nation's character is best discovered; and among the Turks of this class the domestic and social virtues are united with patriarchal urbanity of manners. While the Turkish courtier veils his purposes under the most impenetrable dissimulation, sincerity and honesty are the characteristics of the Turkish merchant: and in their villages, where there is no admixture of Greeks, innocence of life and simplicity of manners are conspicuous, and roguery and deceit are unknown. Dr. Clarke, however, remarks, that the Turks in the provinces are more filthy and wretched than any people among whom he had travelled.

Hospitality, as a religious injunction, is carefully practised by the Turks. Dr. Clarke mentions a remarkable instance of this virtue, which he himself experienced; and which cost his unknown entertainers much trouble and no small expense. The Fanariot Greek, formerly quoted, though no friend to the Turks, allows them the possession of this virtue in no common degree. "At his dinner hour the Mahometan is kind, affable, and circumspect; he makes no display of plate or porcelain. His hilarity is the ornament of his abruptly prepared table. The door of his house is open during dinner, and entrance to his dining room is forbidden to nobody."

The domestic life of a Turk is of a dull and insipid character, compared with the active and artificial enjoyments of European society. The greater portion of his time is spent in voluptuous idleness. Reclining on his sofa with his pipe in his mouth, and his imagination heightened by a few grains of opium, he glides down the stream of existence without reflection or anxiety. Unless when moved by the great passions of our nature, his life is an unvaried reverie. The active bustle of commerce, the sweets of patient industry, the ardours of science, and the desire of public distinction, are all unknown and despised by this phlegmatic people.[*] They are, however, fond of conversation, in which many of them excel, possessing all the graces of polished and manly eloquence; and the *meddhé* or professional story-teller is a favourite in all companies. Whether in private assemblies, or in the coffee-houses, which are thronged during the long evenings of the Ramazan, he is listened to with great delight. His tales are often the invention of his own brain, and are sometimes pleasantly marvellous; sometimes he gives a ludicrous description of foreign and rustic manners, and sometimes he indulges in political satire; and the interest of his story is heightened by the use of wild and rich imagery, and by his impassioned and graceful action. Another amusement among the Turks is the *ombres Chinoises*, which supply the place of dramatic entertainments, and which are an indecent and disgusting representation of male and female figures upon paper, which are sometimes exhibited in the open street, but are chiefly reserved for the more wealthy in their retirements. Their out of door recreations are riding on horseback and throwing the *djerid*, which are considered necessary accomplishments in a Turkish gentleman; and no Turk of any consequence makes a visit, were it only a few doors from his own, but on horseback.

Little attention is paid either to the appearance or convenience of their habitations; the furniture is simple and the same in all ranks, differing only in fineness of quality and richness of ornament; and their frugal meals are enlivened neither with wine nor conversation. The apartments allotted to the women are distinguished by the name of *Harem*, a word signifying a sacred retreat, and which denotes also the female part of a Turkish family taken collectively. The apartments of the men, which are used for the reception of visiters, are called *Selamlik*. No part of the house is exclusively appropriated for bed-rooms. They repose on a woollen matress spread upon the floor, which, with its furniture, consisting of a coverlet, a sheet and a pillow, is removed during the day, so that the same chamber serves for all purposes. Three sides of it are occupied by the sofa raised a few inches from the floor, which, according to the season, is covered with carpets or Egyptian matting. The dinner is served up in a tray, dish by dish, and is placed on a low stool at a corner of a sofa. The master of the family first puts his right hand into the dish, and the others follow his example. They use neither plates nor knives and forks, all luxury and expense in table furniture being strictly prohibited by their prophet, who says, "verily the fire of hell will roar like the lowings of a camel in the bellies of those who eat and drink from vessels of gold and silver."

The Turkish women, according to Lady M. W. Montague, are elegant and beautiful. "They walked about with the same majestic grace which Milton describes our general mother with. There are many among them as exactly proportioned as ever any goddess was drawn by the pencil of a Guido or a Titian, and most of their skins shiningly white, only adorned by their beautiful hair divided into many tresses, hanging on their shoulders, braided either with pearls or ribands, perfectly representing the figures of the graces." This is corroborated by D'Ohsson, who says, "they seem to inherit acuteness of discernment, and delicacy of taste and judgment. Their deportment and manners are graceful and amiable, their conversation chaste and unaffected. I have occasionally met with ladies of quality at the hotels of the ministers or magistrates, and I have admired the purity of their language, their easy elocution, the refinement of their thoughts, the nobleness of their style, and the grace which accompanied their words and actions." Their dresses are made of the richest stuffs of India and Cashmir, and of the finest furs, which, being incapable of being washed, and too costly to be frequently changed, are sometimes retained longer in use than cleanliness and delicacy warrant. Their walking dress consists of a long loose robe, which covers them from the neck to the ground; over that is a large piece of muslin, which wraps the shoulders and the arms, and another which goes over the head and eyes; but this covering is so thin that it leaves them perfectly free to observe all that is passing around them. They are strictly confined to the society of their own sex; and access to the *harem* is interdicted even to their nearest male relations, except upon a few occasions of public or private rejoicings, when the father and father-in-law, the brothers and the uncles are admitted to a short and ceremonious visit. But, though deprived of the society of the men, they enjoy considerable liberty. Women of all ranks indulge themselves in frequent parties abroad, on foot, in boats, or in carriages; and at every public exhibition, at which women can with any propriety appear, they form the most numerous part of the spectators. They also enjoy one another's society in giving fetes, where they regale themselves with coffee, and confections, sherbet and perfumes; and indulge their vanity in the display of their dresses and jewels. Sometimes dancing girls are introduced to these parties, and entertain the company with their exhibitions. The youngest females of the harem occupy their time in working, in embroidering, and in receiving instruction in the elegant arts; and are particularly taught to express themselves with great purity and correctness of language. "I look upon the Turkish women," says Lady M. W. Montague, "as the only free people in the empire: the very *divan* pays respect to them, and the grand signior himself, when a pacha is executed, never violates the privileges of the *harem*, which remains unsearched, and entire to the widow. Neither have they much to apprehend from the resentment of their husbands, those ladies that are rich having all the money in their own hands."

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[*] Lady Craven says, "I once saw a Turk lying on cushions, striking slowly an iron which he was shaping into a horse-shoe, his pipe in his mouth all the time."

Although the professors of Islam are permitted by their law to have four wives by *nikiah*, or civil contract, and a number of slaves, according to their desires or pecuniary resources, yet few avail themselves of this license. Polygamy in Turkey is confined almost entirely to the rich and the great; and in such instances the wives generally are purchased slaves, who rank in estimation according to the number or sex of their children. For when the wife is of equal rank with her husband, she retains her dignity, and the slaves of the *harem* are regarded as her servants or companions.

The Imperial Seraglio forms an important part of the Turkish government, and deserves particular notice. It is composed of two divisions, the *Selamlik*, which is appropriated to males belonging to the Imperial household; and the *Harem*, which is the exclusive abode of the females. The principal functionaries of the Selamlik are the *Enderoun Agalazi*, officers of the interior, who have four departments, called *odas* or chambers. The first *Hasse-oda* consists of 40 officers, of whom the *Silihdar*, or sword-bearer, is the chief. This person, next to the sultan, holds the first rank in the Selamlik. He is the inspector and guardian of the imperial treasure, in which are preserved all the diamonds and precious effects belonging to the crown. "Next in rank is the *Zouka-dar-Aga*, who puts on and takes off the sultan's boots: the 3d, the *Rikiab-dar-Aga*, who holds the stirrup of the sultan when he mounts or dismounts his horse; the 4th, *Dubbend-Agassi*, guardian of the sultan's turbans; the 5th, *Sariktzy-Bachi*, arranges the imperial turbans; the 6th, *Pickekir-Agassi*, carries the napkin when the sultan drinks coffee or sherbet, and is also the bearer of his sublimity's immense writing apparatus; the 7th, *Sir-Kiatiby*, or private secretary; the 8th, *Tzouka-dar*, or chief of the pages; the 9th, *Lahrredzi-bachi*, who presents the cup of coffee; the 10th, *Tirnaklzy*, cutter of his highness' nails; the 11th, *Berber-bachi*, or first barber; and the 12th, *Anahter-Agassi*, keeper of the wardrobe. The remaining 28 officers of the Hasse-oda are unemployed, and wait their turn of promotion." The second *oda*, called *Hazini-odassi*, is the public treasury of the empire, and is under the management of 200 officers with two chiefs, whose duty consists in receiving the money which is daily sent to the treasury. In this department are also deposited much of the crown effects, the imperial library, and the magnificent equipages of the state horses. In the third *oda*, *Kiler-odassi*, or store-room, are kept the furniture, porcelain, China vases, the ornaments of the imperial table, and all sorts of confectionary and preserves. The officers of the fourth *oda*, or chamber of travellers, have at present no function; but in former times they attended the sultan, when he placed himself at the head of a military expedition. Besides these there is a fifth order of officers, the *deaf-mutes*, amounting to eighty, who wear embroidered robes and hats, with gold-lace trimmings, and whose duty it is to attend the sultan in turn in his own apartment. Next in dignity to *Enderoun Agalazi* are the *Bostandzys*, who form the sultan's body guard. Their chief is the prefect of police on both shores of the Bosphorus; and, when the sultan takes an excursion by sea, he stands at the helm of the imperial gondola. These officers have the charge not only of the seraglio, but also of all the pavilions and kiosks of the sultan, and of all the villages of the Bosphorus, and the environs of Constantinople. The next in importance are the *Baltadzys*, who attend on the harem with the black eunuchs; and the *Hassequis*, four of whom wait on the sultan at table, and precede him when he rides in state, each bearing a white baton. Besides these are several other officers, belonging to the Selamlik, but of an inferior rank, who perform the menial services of the seraglio.

Between the Selamlik and the Harem is the apartment of the black eunuchs, who amount to more than two thousand. Their chief is styled *Kislar-Agassi*, ruler of the maids, and sometimes *Darou-s-*

saade agassi, master of the palace of felicity. He is administrator of the entire Harem, and is equal in rank with the Grand Vizier. He has also the superintendance of the imperial mosques, and the pious foundations belonging to them.

The *Harem* is situated in the centre of a large garden surrounded with high walls. Here are secluded an indeterminate number of female slaves of the rarest beauty and accomplishments, Georgians, Circassians, and Lesghians, who have been selected by the sultan or his predecessors, or sent as presents by his female relations and wealthy subjects. From among these the sultan selects his favourites, seven in number, to whom is given the title of *Cadines* or wives. These are ceremoniously invested with a robe or pelisse, which distinguishes them from the other slaves of the Harem. "Each Cadine," says the Fanariot Greek, "has her separate apartment, as have their eunuchs and female slaves. They never meet except on the occasion of an *accouchment*, when the mother receives a congratulatory visit from the other cadines. The directress of the Harem, *Kehaya Cadine*, conducts each night one of the cadines to the sultan's chamber; and when his highness is displeased with either of them, either for barrenness or any other cause, he marries her to one of his subjects, and takes a fresh one in her place; but the cadine who has been delivered of a child, whether it be dead or living, cannot be dismissed from the seraglio. The sultan cannot take any of the cadines left by his predecessor, but on his accession lodges them, with their jewels, &c. in the *Esqui-Serai*, or old seraglio. This immense building is situated in the centre of the city, and surrounded by lofty walls, and destined for the perpetual abode of cadines surviving the sultan. They have there every convenience, and are attended by their eunuchs and slaves. Their children, if male, are, with the other heirs of the crown, shut up in the *cafesse;* but, if female, they are kept in the sultan's harem, under the inspection of the Kehaya-Cadina, till they marry, when they take their mothers from the old seraglio to live with them. The same happens with regard to the mother of a male infant; as soon as her son is raised to the throne, she is by him taken from the old seraglio, receives the title of *Validi Sultana*, and is accommodated with apartments in the imperial seraglio.

The Turkish language is written in the Arabic character, and is evidently of Tartar origin; but its writers have borrowed so copiously from the languages of Persia and Arabia, that it has received the appellation of *Mulemma*, or the "pied mare." Mr. Thornton says, "no language is better suited for colloquial purposes;" and though he maintains that it excels in dignity and gravity, he allows that it is deficient in terms of art, and in expressions adapted to philosophical ideas. Among this people literature, science, and the arts are still in their infancy; and this is no doubt owing, in a great measure, to the exclusive nature of their religion. They treat foreign nations with the utmost contempt, on the ground of their infidelity, and consequently they despise the arts of foreign invention. The great discoveries of modern Europe have thus been entirely lost upon them, and they remain in nearly the same state of ignorance as when they first left the banks of the Oxus. In their *medresses*, or colleges, the principal branches of study are, grammar, rhetoric, Persian and Arabian poetry, with the logic and philosophy of the dark ages. History, geography,* and mathematics,† are completely neglected, while judicial astrology is held in high estimation by all ranks;‡ and their physicians are mere pretenders to supernatural skill. Their ministers of state are even unacquainted with the statistics of their own country; and their knowledge of the governments, the diplomacy, and the relations of European states is very superficial. This, however, is not so much to be wondered at, when we consider that "the highest offices of the state are administered," says Dr. Clarke, "by individuals taken from the dregs of society; and when we were admitted to the friendly intercourse and conversation of those among them who are the most looked up to, either on account of their elevated rank or probity of character, we were constrained to regard them rather with affection than with esteem; as claiming the same degree of regard mingled with pity, which is excited by the goodness and simplicity of very benevolent, but very illiterate old women."

The art of printing is almost unknown in this country. It was first attempted to be introduced into Constantinople in 1727; but it has never been able to acquire a permanent footing, having been uniformly and successfully opposed by an immense tribe of copyists, whose means of living it threatened to destroy. The printing of the Koran and all books which treat of the doctrines and laws of the prophet is still strictly prohibited, as great sanctity is attached to the writing of their sacred volume. Of late it has received some encouragement from the government, and under its auspices the first scientific work from the Turkish press appeared in 1820, namely, a Treatise on Anatomy, Medicine, and Therapeutics, by Chanizadeh, a member of the Ulema, partly taken from the French, German, and English authors, in one volume folio, with 56 copperplates. The great bar, however, to the success of this art in Turkey, is the ignorance of the people. They have not yet acquired the rudiments of knowledge; and until these be introduced and naturalized, printing can be attended with no benefit.

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* In the first war of Catharine II., when the news spread that a Russian fleet was to pass Gibraltar, the Ottoman ministry were alarmed, but did not know where Cronstadt, Gibraltar, the Mediterranean, or the Archipelago, was situated. A map was produced and the places pointed out, when the *Reis Effendi* said disdainfully, "How could ships of the line possibly pass through so narrow a strait?" He believed that the strait of Gibraltar was as narrow as it was marked on the map.—*Foreign Review.*

† "Baron de Tott, being desired to confer with the chief of the geometricians, asked them how many right angles there were in the angles of a triangle; the boldest of the state mathematicians, after due deliberation, learnedly replied, that it depended upon the size of the triangle."

‡ In the sultan's household there is an officer called *munedjim bachi*, or chief of the astrologers, who is consulted on all occasions which relate to the health and safety of the sultan; and also as to the particular day or instant when any important public business is to be undertaken.

Turkish ignorance and neglect are not confined to literature and the fine arts. They pervade every department of national industry; and are aggravated in the latter case by the rapacity of the government, which renders every species of property insecure and even dangerous to its possessor. It cannot be expected that any man would exert his skill and risk his capital in agricultural, mercantile, or mechanical speculations, when he knows that his success would only make him a more conspicuous mark for the cupidity of a pacha, and render his destruction certain. Agriculture is consequently in a languishing condition. The exportation of its produce is strictly prohibited; and those fields are indifferently cultivated which are liable to be reaped by a rapacious governor, or its produce transported to the capital to keep in quietness a turbulent population. Yet, in spite of impolitic restrictions and arbitrary seizures, such is the fertility of the soil, that few countries are more abundantly supplied with all the necessaries of life. Its corn, maize, and rice are of superior quality; but its wine and oil are much deteriorated by the unskilful and negligent method of preparation. The immediate vicinity of Constantinople is barren and unfruitful; but its inhabitants are richly supplied from the surrounding coasts with all the culinary herbs and fruits of exquisite flavour which the most fastidious appetite can require.

The manufactures and commerce of Turkey are chiefly in the hands of foreigners. Of the former, the principal are, the satins, silks, and velvets of Brussa and Aleppo; the serges and camelots of Angora; the crapes and gauzes of Salonica; the printed muslins of Constantinople; the carpets of Smyrna; and the sabres of Damascus. Some of these, especially their works in steel and copper, and their dyed stuffs, equal any in Europe.

Few countries are better situated for an extended and lucrative commerce than Turkey. She has ready access to the commodities of Europe, Asia, and Africa; and her intercourse is admirably facilitated by the openings which the Mediterranean sea, the Red sea, the Persian gulf, and the river Euphrates afford to the two great oceans of the globe. The advantages of her situation, however, could only be appreciated by a mild and enlightened legislature. But every thing here is sacrificed to the cupidity of the government. Foreign goods are admitted without restriction, upon paying a certain duty; but while the foreigners pay three or four per cent, the native merchant is charged double. The commerce with Egypt and Syria employs only about thirty large vessels; and the ports of the Black sea, on the Asiatic coast, and those of the Crimea, before its conquest by the Russians, were furnished by about 100 clumsy vessels, called *Saika*, which had the appearance more of floating carcasses than regular ships. The internal trade is carried on by means of caravans, which traverse the country from the Hungarian frontier to the Persian gulf. From Bassora, the products of India and Persia are conveyed to Aleppo and the principal cities in Asiatic Turkey; and Smyrna is the centre of all the traffic of Asia Minor.

The Turkish institutions have all a reference to the military character of the nation. All mussulmans, in the eye of the law, are soldiers, and form a distinct class from their infidel fellow subjects. The extension of their empire, and the propagation of their faith, were the avowed objects of their warfare; but they conquered to inherit; and, as they knew no honourable means of subsistence besides arms, they left the cultivation of the ground, and the practice of the arts, to the vanquished natives. Upon the conquest of a country, a third part of the land was allotted to the officers and soldiers, to be held by them in consideration of performing military service; and these lands were cultivated exclusively by the *rajahs,* who paid as rent a tenth of the produce and of the increase of their stock. These lordships are denominated *Ziamets* and *Timars*, according to their revenue, that of the former being from 20,000 to 100,000 aspers, while that of the latter is from 5000 to 20,000 aspers. A Ziam, for every 5000 aspers of rent must bring one horseman into the field, with tents and other necessary equipage; and a timariot must produce one for every 3000 aspers; but if his revenue does not exceed 5000, his personal service alone is required. These proprietors are enjoined by this charter to take up arms at the summons of the sovereign, to remain encamped with their stipulated contingents as long as he judges it expedient, and to return home at their own charge. These troops are disposed into regiments under the command of agas, and these again under the pachas of the provinces. This system resembles, in some parts, the feudal tenures of the northern nations; but here there are no subordinate vassals, all are equally crown vassals; nor are they in general hereditary. The Ottoman military fiefs are held immediately from the crown, and the grants, on the demise of the incumbent, are vested anew in the sultan. In Anatolia, however, the estate devolves to the next of kin; and the possessor is not bound to serve in person; but if he fail to furnish his quota of troops, one year's rent is confiscated to the exchequer. The fiefs of those who die in battle also are conferred upon their children; and an aged or disabled warrior is allowed to send his son as his substitute, who succeeds to the lordship on the death of his father. All vacancies are immediately filled up by the sultan; and Rycaut mentions, that in the different assaults upon the fort of *Serinswar*, one Timariot's farm was bestowed eight times in one day. The revenues of the unallotted lands "were appropriated to mosques, and the great officers of state, to the mother and mistresses of the sultan, to children of the imperial family, or to the sultan himself; and the residue, burdened with a territorial impost or land tax, was left by an undefined tenure to the ancient proprietors. These, if mussulmans, had the privilege of going to war: others, whether Turks or infidels, who from choice or from civil incapacity devoted themselves exclusively to the arts of peace, and enjoyed their estates under the common protection of the crown, were called *beledis* or *rayahs*, and their military service was commuted by a tribute. The mussulman proprietors of this description thus formed the national, and the feudal proprietors the feudal militia." These militia are denominated *toprakly*, to distinguish them from the *capiculy* or regular troops, who receive their pay from the treasury of the prince.

Of the regular troops the *Spahis* are the most ancient, and at first formed the body-guard of the sultan. This corps consisted of the flower of the Turkish youth, being the sons of wealthy mussulmans; and were held, on account of their accomplishments and birth, in great honour and esteem throughout the empire. But in consequence of their frequent mutinies and rebellions, they were severely punished in the reign of Mahomet IV., and they now form an inconsiderable force of 15,000 men.

The order of *Janissaries*, who were long the chosen troops of the Ottomans, was instituted by Amurath I. He claimed a fifth of the christian captives, whom, having instructed in the Mahometan faith, and disciplined to arms, he formed into a body of infantry of 12,000 men. The formation of this force was consecrated by the prayers of *Hagi Boktesh*, a celebrated dervise, who, placing the sleeve of his gown upon one of their heads, said, "Let them be called *Yengi-cheri*, (young soldiers); let their countenance be ever bright, their hands victorious, their swords keen; let their spears always hang over the heads of their enemies; and wherever they go may they return with a shining face." This order, however, was in a great measure remodelled by Amurath II. When the royal fifth of the captives was diminished by conquest, he levied a tax of every fifth child upon his christian subjects. At the age of fifteen they were torn from their parents, had their names enrolled in a book; and from that moment they were clothed, taught, and fed for the public service. Their bodies were inured to fatigue by the athletic exercises of wrestling, leaping, and running, and when drafted into chambers and companies of the janissaries, were severely trained in the military discipline of the order. This institution gave a decisive superiority to the Turkish arms, as it presented a system of discipline, and a permanency of organization till then unknown in Europe; and these celebrated and formidable troops continued to be the terror of the surrounding nations. They were blindly devoted to the person of the prince, and were always reserved for the most difficult and perilous actions. To them were intrusted the protection of the capital, and also the frontier garrison towns. The sultans and their sons were uniformly members of this body; and, from the privileges which they enjoyed, and the high consideration in which they were held, many were attracted to their standard; and at one time a great portion of the youth of the empire were enrolled in the regiments of the janissaries. Those only, however, who were quartered in their barracks at Constantinople, and in the garrisons, were entitled to receive pay; and these amounted to about 40,000. While the reins of government were held by warlike and energetic sultans, this institution was the great support of the throne and the empire; but when these reins were relaxed in the hands of weak and effeminate princes, the janissaries became the instruments of aspiring and intriguing men, particularly the Ulema, who by their assistance deposed or murdered their sovereigns whenever it suited their ambitious and selfish purposes. Like the Prætorian bands of Rome, the janissaries thus acquired an ascendancy in the affairs of government alike destructive of the prosperity and happiness of the nation. Whatever abuses they committed, were tolerated through fear. The revolts in the capital were always embraced from an *esprit de corps*, by the janissaries of the provinces; and being sanctioned by the Ulema, were considered as triumphs against their common enemy the sultan. Amurath IV., whose enmity they had roused, and whose feelings they had outraged by rising in sedition and massacring his favourite before his eyes, watched only for an opportunity of revenge. Returning victorious from an expedition against Persia, surrounded by numerous Albanian, Bosniak, and Kurdish military chiefs, whose attachment he had secured, he ordered for execution all the officers and soldiers of the janissaries who had been active in the sedition against him. He also sent an army into Asia Minor, then the focus of janissarism, and exterminated all belonging to the order in that province; and so great was the number of his victims, that for the sake of concealment, he ordered deep wells to be dug, into which they were thrown by hundreds. This severe chastisement effectually curbed this turbulent soldiery during the remainder of his reign; but after his death a succession of revolts deluged the Ottoman throne with blood. Mahmoud I. who owed his throne to the last of these revolts, saw his danger, and formed the design of overcoming the power and violence of this body, by promoting among them a love of ease and indulgence. "He continued their pay, allowed them to pursue any trade, and invested them with exclusive commercial privileges; so that he gained their love and subdued their ferocity." They thus lost by degrees their military habits, became more attached to their lucrative occupations than to arms; and at length were so enervated and degraded, that they were despised for their cowardice and military ignorance. In the Russian wars they were uniformly beaten, almost without a show of resistance, and retained nothing of the soldier but the name. Their last revolt, in 1806, cost Selim III. his throne and his life; but his successor, Mahmoud II. has succeeded in completely dissolving the corps, and in introducing European tactics into his armies. The next in importance to the janissaries are the *topgis* or gunners, amounting to 30,000 men, some of whom are quartered at *Tophana*, where there is a cannon foundry, and the rest are dispersed throughout the empire; the *gebegis* or armourers, who are divided into sixty companies, and have their barracks near the mosque of St. Sophia; and the *sakhas* or water carriers, who attend in the field, and supply the troops with water, which their frequent religious ablutions render necessary.

The Ottoman navy is scarcely worth a passing notice. It is neglected both with respect to its *materiel* and its physical force; and is commanded by ignorant admirals and officers, served by unskilful gunners, and worked by unexperienced sailors. The late Hassan Pacha, who was originally a Georgian slave, when he became grand admiral, infused a species of activity into the maritime affairs of Turkey, by the selection and discipline of his officers, and the improvements he made in the construction of ships of war. He sent for European builders, and spent immense sums in building, equipping, and decorating his fleet; but since his death the Turkish marine has been visibly declining, and has fallen into a state of torpor and decay.

The following table of the Ottoman armies, according to *M. Hammer*, is taken from M. Malte Brun, who states that it does not include the provincial troops furnished by the pachas.

Infantry, 100,000 men, namely,	
Janissaries (two hundred odas)	80,000
Dgebedgis, armourers,	6,000
Topdschis, matrosses,	10,000
Top-Arabadschi, in the train of artillery,	3,000
Koumbaradschi, bombardiers,	600
Lagoundschi, miners,	400
Nisami Dgedid, regular new troops, (lately suppressed) 24,000.	
Regular Cavalry, 24,000, namely,	
Sipahis, horsemen,	11,000
Silihdars, horse police,	11,000
Ouloufedschiani, mercenaries,	1,000
Gouroubai, foreigners,	1,000
Irregular feudal cavalry, 100,000.	
Standing army in time of peace, 79,500.	

The revenues of the Porte may be divided into three parts: the *Miri*, or public revenue; the *Hazné*, or sultan's treasure; and the *Vacufs*, which are consecrated to religious and charitable institutions.

The Miri is under the superintendance of the *defterdar effendi*, and thirty-three inferior officers. It is derived principally from the following sources: the *miri*, properly so called, which is a territorial impost levied on the whole empire, amounting to one-tenth of the produce of the land; the *haratch*, or poll-tax, imposed only upon the *rayahs*, and varying from four to twelve piasters a-head; a tax on personal property and the produce of industry, calculated at a fourth of the tradesman's gains; the customs on the exportation and importation of merchandise, and the produce of monopolies, particularly of bread corn, and confiscations, the amount of which must be very considerable, as every officer under government, with the exception of the Ulema and the janissaries, virtually stipulates that the state shall inherit the whole of his property at his death. To these may be added a tax upon certain provinces, levied in kind, such as contributions of timber, hemp, sail-cloth, iron, tar, &c. as materials for the navy and arsenal, and estimated at 2000 purses. Of late it has been attempted to improve this revenue, and to support a greater standing military force, by imposing an excise tax; but this innovation was so ill received, that it has as yet produced very little benefit. In estimating, however, the value of the miri for the emergencies of the state, we ought to take into account that the third part of the lands is held upon the condition of the proprietors raising and maintaining the feudal militia; that the governors of provinces are bound to keep in order the national establishments in their particular districts; and hence, that neither "the army, nor the administration of justice, the police, public worship, the building or repairing of public edifices, of fortresses, mosques, arsenals, bridges, and high roads, are kept up in the provinces at the expense of the Grand Signior." This revenue is called *beith-ulmali musleminn*, the public money of the Mussulmans, consecrated to the necessities of the state, and over which the sultan has no control.

The *Hazné*, or sultan's treasure, which is administered by the *hazné-vekili*, is devoted to his own private use, and is so ample as to enable him to lay aside a considerable sum of money every year. It is derived chiefly from the rents of the imperial domains; from the gifts under the name of *peshkesh*, which he receives on the nomination to great offices, and the magnificent presents which are sent to him from all parts of the empire on certain festivals, or on occasions of solemnity, such as the birth or circumcision of a son, which last Cantemir estimates as equal to half the yearly tribute of the empire. The exactions, from the provinces, of provisions of every description for the use of the sultan's household, form no small addition to his revenue; and "it may be asserted," says Mr. Thornton, "that the supplies from the provinces are such, that nothing which the empire produces is ever bought with money for the service of the seraglio."

The revenue of the *Vacufs*, amounting to several millions, are deposited in the seraglio, under the care of the kislar-aga. They are derived from endowments, either in land or money, made by sultans and private individuals, for building and upholding mosques, and for other religious and charitable purposes; these funds, though considered sacred, have sometimes, in cases of urgency, been applied to the necessities of the state, but always under the form of a loan, and the sultan and the empire are bound for its repayment.

It is almost impossible to ascertain with any degree of exactness the amount of the Turkish revenues, especially of the *Hazné* and *Vacufs*. Mr. Eton makes the haratch, or capitation tax in Europe and Asia amount in 1776 to 19,538,500 piasters, and the general taxes, or farms of the empire, to 18,397,000. These are the fixed revenues of the *Miri*. The casual revenue, arising from confiscations, &c. amounted to 6,907,000 piastres; so that the total amount of the Miri, or public treasury, was 44,942,500 piasters, or about £4,492,250 sterling. The expenditure of the same year is stated at 36,968,133 piasters, or about £3,696,813 sterling.

The taxes in this country, though unequally distributed, would not be so severely felt were it not for the violence and rapacity which attend their collection. "In Greece," says Lord J. Russel, "the *haratch*, and the tax on personal property, were farmed by the pachas to Greeks, called Codjabachis, who vexed by every kind of extortion and oppression, their unfortunate countrymen. If the population diminished, or riches decreased, in a particular district, the remaining inhabitants were obliged to bear the increased burden, and the ruin of the district was thus hastened and insured. The collector took special care to enrich himself: in the Morea it was imagined that the taxes in that province gave two millions of piasters to the sultan, a million to the pacha, and about a million and a-half of francs to the codja-bachis." But, however oppressive the regular taxes, they are light in comparison with the extortion of the pachas. Though we must receive, with some allowance, the assertion of Mr. Eton, "that the principal occupation of every pacha is to suck out the very vitals of his province;" yet when we consider that the governors are frequently changed, and that there is no limit to their exactions but their own feelings of compassion, little reliance can be placed upon their humanity. "If a pacha is ambitious, his only means of maintaining himself are by large presents to the porte, or a force sufficient to defend his independence; if he is covetous, he unavoidably makes use of the sunshine of his prosperity to amass a treasure; if he is fond of ostentation and expense, he draws from the vitals of the people the resources for his prodigality. Thus ambition, avarice, profusion, from one or other of which passions few mortals, with the power of indulging them, are free, alike mar the happiness of the unfortunate rajahs of Turkey."*

HISTORY.

The obscurity in which the Turkish annals are involved, have prevented historians from tracing, with any degree of accuracy, the origin of those warlike tribes, who, under the name of Ottomans, have subjected to their dominion, and covered with ignorance and despotism, some of the fairest and most fertile portions of Asia and Europe. The Turkish writers claim their descent from *Turc*, the eldest of the eight sons of Japhet, who is represented as the great progenitor of the Tartar tribes, or Huns, who dwelt in tents, and occupied, with their flocks and herds, the extensive plains on the north of China, India, and Persia, between the Caspian and the sea of Japan; and parts of which have received the name of Turkistan. Little, however, is known of the history of this country until the middle of the sixth century, when one of these tribes, denominated Turks, who inhabited the Altai mountains, and were chiefly engaged in the manufacture of iron, renounced their allegiance to the Geougen Tartars, to whom they had been long subject. After repeated victories, under Bertezena, their first leader, the name and dominion of the Geougen were extinguished; and the subject tribes, marching under the standard of the Turks, were led to distant and important conquests. On the banks of the Til they overthrew the khan of the Ogors or Varchonites, with 300,000 of his subjects. They subdued the Nephthalites, or White Huns, a polished and warlike people who then inhabited Great Bucharia, and in the invasion of China their forbearance was purchased with splendid gifts. In the course of fifty years they had established a powerful empire, extending from the wall of China to the sea of Azoff, and were connected in peace and in war with the Chinese, Persians, and Romans. They continued, like their fathers, to wander from place to place without any fixed habitations; and their favourite exercises were hunting and war. Attached to their native seats, the royal encampment was seldom far removed from mount Altai; and when the Roman ambassadors were first presented to Disabul, their khan "the tent of the monarch," according to Mr. Gibbon, "was surrounded with silk hangings, embroidered in various figures, and the royal seat, the cups, and the vases, were of gold. Another pavilion was supported by columns of gilt wood, a bed of pure and massy gold was raised on four peacocks of the same metal, and before the entrance of the tent, dishes, basons, and statues of solid silver and admirable art, were ostentatiously piled in wagons, the monuments of valour rather than of industry."

The Romans frequently experienced the benefit of the Turkish alliance, by their powerful diversion, on the side of the Oxus, against their common enemy the Persians. But this extensive empire, after a duration of 211 years, fell by its own weight. The princes of the blood, who were appointed to the government of its distant provinces, soon forgot their gratitude and their allegiance, and the vanquished tribes were encouraged and supported by the policy of China in resuming their independence.

After the dissolution of this empire, many of the Turkish chiefs obtained other thrones, and more wealthy dominions. The family of Samanee usurped the sovereign authority in Persia, which they held for 125 years, and were succeeded by that of Ghizni, where Sultan Mahmood was one of the greatest monarchs that ever sat upon the throne of Persia. After the short period of forty years, they, in their turn, were supplanted by the shepherd kings of the tribe of Seljookee, who extended their dominion from China over Anatolia, Syria, and Egypt. The unity of this mighty empire was dissolved by the death of Malik Shah, and while Persia continued subject to the elder branch, the younger dynasties of the house of Seljookee established the kingdoms of Kerman, Syria, and Roum, or Anatolia.

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* M. Beaujour, quoted by Mr. Thornton, mentions the case of the pacha of Salonica, in 1799, whom he extols for his humanity and disinterestedness. This pacha held by direct tenure about twenty villages, whose revenue he farmed for 60,000 or 70,000 piastres, and collected besides, at least, an equal sum for casualties; yet it is said, that by avaricious extortions, his pachalik yielded to him 360,000 piasters (24,000*l.* sterling) without having recourse to compulsory or tyrannical measures.

The kingdom of Roum, in which the others eventually merged, extended from the Euphrates to Constantinople, and from the Black Sea to the confines of Syria, with Nice for its capital; and Soliman, its first sultan, had his conquests confirmed to him by a treaty of peace with the Emperor Alexius Comnenus. But his successor was driven from his capital by the arms of the crusaders, and the battle of Dorylæum stript him of all his territories upon the sea-coast from Trebisond to the Syrian gates. After the loss of Nice, the royal residence was removed to Iconium, an obscure inland town above three hundred miles from Constantinople. Here the successors of Soliman continued to reign for nearly a century and a-half, engaged in almost incessant hostilities with the Greek emperors, until Anatolia was overwhelmed in the general wreck by the ravages of Jenghis Khan and his successors. The sultan of Iconium, after a feeble resistance, fled for refuge to his former enemies, the Greeks of Constantinople, and the fragments of the Seljookian monarchy were seized by the emirs or governors of the cities and provinces, who continued to exercise an independent dominion until their territories became gradually and imperceptibly incorporated with the Ottoman empire.

One of these emirs was Othman, from whom the Ottomans derive their name. His grandfather Soliman, who, with other Turkman chiefs, had attached himself to the fortunes of the sultan of Carizmé, after the dispersion of the Carizmean army by the Moguls, directed his course towards the west, and perished while attempting to cross, on horseback, the waters of the Euphrates. Orthogrul, the eldest of his sons, led his forces into Anatolia, and having obtained a grant of territory from Aladdin, the sultan of Iconium, he established a camp of 400 tents at Surgut, on the banks of the Sangar. Placed on the verge of the Byzantine empire, he made constant incursions into its territory; and, being appointed generalissimo of the army of Iconium, he persevered for half a century in preserving and extending his conquests in that quarter. Othman succeeded to the lordship of Surgut, and continued to be the subject and soldier of Aladdin II. the last monarch of the house of Seljookee, till the death of that prince, when he and the other chiefs, as has been already mentioned, seized each of them a share of the dominions of Iconium.

The territory of Othman was but of small extent compared with the other governments which surrounded him. *Caraman*, from whom the modern Caramania derives its name, had seized upon the city of Iconium, Celicia, part of Lycaonia, Pamphylia, Caria, and the greater Phrygia, as far as Philadelphia, and the city of Antioch. *Aidin* held the greater part of Mysia with part of Lydia; and the chief parts of the latter province with part of Mysia, Troas, and Phrygia, submitted to *Caras.*

The sway of *Sarukham* extended over the maritime provinces of Ionia, as far as the city of Smyrna; and Pontus and Paphlagonia, comprising many important cities upon the Euxine, formed the principality of the sons of *Omer.* The small lordship of Surgut, with some strong holds which he had won from the Christians, was all that acknowledged the sway of Othman, but it formed the nucleus of a mighty kingdom, which embraced within its limits extensive dominions in each of the three quarters of the old world.

The vicinity of Othman to the Greeks opened to him a wide field of enterprise; and the civil broils between the elder and younger Andronicus, which at this period agitated the Byzantine empire, leaving their Asiatic subjects to their own resources, they became an ease prey to the first invaders. Othman having established his residence at Neapolis, about 20 miles from Nice, now began to assume the prerogatives of royalty by coining money, and commanding his name to be used in the public prayers; and, taking advantage of the weakness of his enemies, pushed his conquests over the greater part of Bithynia. The Christian princes, alarmed at his progress, united their forces, and endeavoured, by one decisive effort, to crush the rising power of the ambitious Turk. The hostile armies met on the confines of Phrygia and Bithynia, but Othman was victorious; and the city of Brusa, a few years after, submitted to his son Orchan, who made it the seat of the Ottoman government. The policy of Othman was equal to his military skill; and what he won by his valour, he secured by wise and salutary regulations. By the impartial administration of justice and mercy, he reconciled the conquered Christians to his government; and many, who fled before his arms, returned to enjoy safety and repose under his powerful protection.

Orchan prosecuted with vigour the ambitious designs of his father. He defeated the Christians headed by Andronicus in person, who was wounded in the engagement near Philocrene; and, having taken Nice and Nicomedia, extended his dominion to the Hellespont. In the civil war, which succeeded the death of Andronicus, between the Empress Anne and John Cantacuzene, for the regency of the empire, the latter solicited the aid of the Turkish emir, and secured his friendship and services by bestowing upon him in marriage his daughter Theodora. The services of ten thousand horse led by Soliman, the son of Orchan, repaid the obligation; but, by the admission of these auxiliaries into Europe, the empire received a deep and deadly wound which succeeding emperors in vain endeavoured to heal. The Turks, as the friends of Cantacuzene, had seized upon the fortresses of Thrace; and though their restitution was demanded, and a ransom paid, they still held the most important; and Gallipoli, the key of the Hellespont, was peopled by a Turkish colony.

At the same time that Soliman was securing a footing in Europe, and had opened a gate by which he could enter at will into the empire, his father had brought many of the neighbouring emirs by force or by fraud to seek his protection, and resign their independence. But while he was enlarging his dominions and cementing his power, his death was hastened by the intelligence that his favourite son Soliman was killed by a fall from his horse. Orchan is extolled by his countrymen for his justice, clemency, and liberality to the poor. He adorned the city of Brusa with a magnificent mosque, hospital, and academy, and was the first of the Turks who assigned regular pay to their troops while on duty.

Amurath succeeded to the sceptre, and wielded with dreadful effect the scymetar of his father. He overran the whole of Thrace from the Hellespont to Mount Hæmus, and established Adrianople as the capital of his European dominions. From the numerous Christian captives which he carried off in this war, he selected the stoutest and most personable, whom having instructed in the Mahomedan faith and disciplined to arms, he formed into a body of infantry called Janissaries (Yengicheri, new soldiers.) These troops continued the firmest and most faithful supporters of the Ottoman throne, and to them he was indebted for many of his most important victories. He was, however, recalled from his European conquests by disturbances in Asia. Aladdin, sultan of Caramania, who had married a daughter of Amurath, and was the most powerful of the Turkish emirs, by his influence with the minor princes of Anatolia, had collected a numerous army, and, taking advantage of the absence of his father-in-law, invaded his dominions. Amurath hastened to repel this aggression. They engaged on the plains of Dorylæum, and, after a well-contested field, the Caramanians fled, and Aladdin shut himself up in the city of Iconium. At the intercession of his queen, who was dear to her father, Aladdin was again received into favour, and had his kingdom restored to him. In this expedition war was prosecuted with comparative mildness, both parties being Mahomedans; and a proclamation was issued by Amurath, prohibiting his soldiers, upon pain of death, from using violence towards the peaceable inhabitants, to show to the world that he made war upon his brethren, not for the sake of aggrandizement, but to repel unmerited injury and wrong; and he punished severely some Christian auxiliaries for transgressing his orders. These auxiliaries had been sent by Lazarus, prince of Servia, who, being informed of their treatment, was so offended that he broke off his alliance with the Ottoman, and having formed a confederacy of the neighbouring tribes, appeared at the head of a mighty army, consisting of Bulgarians, Macedonians, Bosnians, Wallachians, Hungarians, &c. Amurath having collected his tributaries, hastened to meet him on the plains of Cassova. The battle was long and doubtful, until the Turks, pretending to give way, threw the Christian ranks into disorder. A dreadful slaughter ensued, when the confederates fled, leaving the field to the victorious Ottomans. Lazarus fell in the engagement; and the triumph of Amurath was but short-lived, for, while walking over the field of battle and viewing the heaps of slain, a Servian, starting from the ground, pierced him in the belly with a fatal wound. This prince was fortunate in all his enterprises, and was a more zealous promoter of religion and learning than any of his predecessors. He encouraged an impartial administration of the laws, and submitted to the reprimand of the mufti, who rejected his evidence as unworthy of credit in a court of justice, because he never joined in common prayer with his brother mussulmans. The erection of a spacious mosque at Adrianople was the consequence of this challenge, and as an atonement for his former neglect in this respect. (See AMURATH, Vol. I.)

Bajazet, the son of Amurath, introduced the unnatural and inhuman custom of securing his own elevation by the murder of his brother, an example which has been too invariably followed by his successors. During the whole of his reign, he was incessantly engaged in hostilities alternately in Asia and Europe, and obtained the surname of *Ilderim*, or lightning, from the energy and rapidity of his movements. Following up the victory of Cassova, he took the cities of Cratova and Widin, and stripped of their hereditary possessions the emirs of Aidin, Sarukham, and Caras. In the same year he overran the whole of Moldavia, and defeated prince Stephen on the banks of the Siret. The fugitive prince was refused admittance into the fortress of Nemza by his own mother, who branded him with cowardice, and exhorted him to return and retrieve his honours. Having collected 12,000 of the dispersed Moldavians, Stephen fell upon the Turkish army while intent on plunder, and routed them with great slaughter. The haughty Bajazet with difficulty escaped with a few followers to Adrianople. More enraged than discouraged by this disaster, he delayed his revenge until his return from Asia, whither he was summoned to quell an inroad of the Caramanians. These he scattered at the first onset; and having put their prince to death, seized his dominions, and thus annexed the whole of Anatolia to the Ottoman sceptre.

On his return to Europe, Bajazet conquered what remained of Thrace, Macedonia and Thessaly, and stationed a fleet of gallies at Gallipoli to secure his communication between the two continents, and to intercept the Latin succours to Constantinople, which city he was now resolved to reduce. But the capital was saved by the intelligence that an army of 100,000 Christians, led by Sigismund, king of Hungary, and the bravest knights of France and Germany, had taken Widin and besieged Nicopolis. Bajazet opposed them with 60,000 Turks, when the confederates were almost annihilated, few escaping the Turkish scymitar, and the waters of the Danube. All the prisoners were put to the sword, except the Count of Nevers and four and twenty Lords, who, after a harsh captivity, were released for an exorbitant ransom.

Bajazet returned to the siege of Constantinople, but the fate of this city was once more delayed by the appearance of another conqueror upon the scene—

the mighty Timour. The oppressed princes, who had been driven from Anatolia, repaired to the court of Samarcand, and solicited the countenance and assistance of its sovereign in recovering their patrimonial dominions. Timour at first hesitated to interrupt Bajazet in his pious occupation of humbling the Christians, and extending the religion of the prophet; but he at length despatched an ambassador to the court of Brusa, who was instructed to demand the restoration of the exiled emirs, and to offer the robe of vassalage to its monarch, who was exhorted to testify his submission by substituting the name of Timour for his own upon the coinage, and in the public prayers. The haughty Ottoman, who acknowledged no superior, rejected with scorn the degrading compromise, and threw back his defiance in the most insulting terms that his pride and indignation could dictate. Equally confident in their own resources, each prepared for the decisive struggle; but while Bajazet flew with the speed of lightning to satiate his revenge, Timour proceeded with a cautious alacrity, which his opponent compared to the crawling of a snail. The defeat and captivity of Bajazet was achieved on the plains of Angora; but the Ottoman survived his disgrace only nine months. (See BAJAZET, Vol. III.)

Of the five sons of Bajazet, *Mustapha* was said to have fallen at Angora; *Soliman* escaped from the field of battle to Adrianople, and preserved the Ottoman sceptre in Europe; *Musa* was invested by the conqueror in the circumscribed kingdom of Anatolia, with the ruins of Brusa for his capital; *Isa* held a small territory in the neighbourhood of Angora, Sinope, and the Euxine; and *Mahomet* kept the government of Amasia, which had been entrusted to him by his father. Eleven years of civil discord, which period in the Turkish annals is considered an interregnum, were consumed by the sons of Bajazet in mutual endeavours to supplant his brothers. Soliman, having driven Musa from his throne, united for a time the governments of Adrianople and Brusa; but he, in his turn, was surprised by Musa in his capital, and, as he fled towards Constantinople, was overtaken and slain. Musa and Isa both fell before the valour and policy of their younger brother, so that the dominions of Bajazat were reunited under the Ottoman sceptre in the hands of Sultan Mahomet.

The labours of this prince were directed chiefly to consolidate his power, and to preserve the tranquillity of his dominions. He maintained inviolate his friendly engagements with the Greek emperor during the whole of his reign; and his treatment of the Christian ambassadors from Servia, Wallachia, Bulgaria and Greece, showed his anxious desire to cultivate a good understanding with his neighbours. They were admitted to eat at his own table; and after being entertained with great kindness and hospitality, he dismissed them, saying, "Tell your masters that I offer them peace, that I accept of that which they offer me, and I hope that the God of peace will punish those who violate it." His last care was to provide two able counsellors, Bajazet and Ibrahim, to guide the youth of his son Amurath; and he assigned his two younger sons to the guardianship of the emperor Manuel.

Amurath II. was only eighteen years of age when he began to reign; and immediately the peace of the kingdom was disturbed by the pretensions of Mustapha, the eldest son of Bajazet, who was supposed to have been slain in the battle of Angora. This impostor, for so he is termed by the Turks, had appeared in the former reign supported by the prince of Wallachia; but Mahomet having routed the Wallachians, and compelled them to submit to an annual tribute, Mustapha sought refuge in Constantinople. Upon the accession of Amurath, his claim was renewed under the sanction and with the support of the Greek emperor, in revenge for the refusal of the sultan to deliver up his two brothers according to their father's will. The Turks under the vizier Bajazet were routed and their leader slain; and Mustapha enjoyed for a time the throne of Adrianople. There, in possession of the inestimable treasures and harem of Amurath, he abandoned himself to voluptuousness. He was soon, however, roused from his dream of pleasure by the intelligence that Amurath was in the field; and, after a short campaign, Mustapha, deserted by his friends, exchanged a splendid throne for an ignominious gibbet. The Greek emperor raised up another competitor for the Ottomon sceptre in the person of the remaining son of Mahomet, a child only six years old, who had escaped from the hands of Amurath while his brother was murdered, but the gates of Nice, whither he had been conveyed, yielded to the golden key of Amurath, who ordered him to be strangled and his guards slain.

Relieved now from every legitimate rival, and incensed by the encouragement given by the Greeks to the claims of his brother and pretended uncle, Amurath resolved to direct the whole strength of his empire against the capital; but he was continually diverted from his purpose by the rebellions of the Caramanian emirs on the one hand, and the incursions of the Hungarians on the other. The former were easily reduced, but the Hungarians, led by John Huniades, proved a more formidable foe; and Amurath was compelled to retire with disgrace from before Belgrade after a siege of six months, during which he lost many troops, "not only by the plague," says a Greek historian, "but by engines, cast in the form of tubes, which by means of a dust, composed of nitre, sulphur, and charcoal, shot out balls of lead, five or ten together, each as big as a walnut." The resistance of the Hungarians led to a truce of ten years, in which it was stipulated that neither nation should cross the Danube for the purposes of war. Amurath, however, conquered a great part of Greece, took Thessalonica by storm, putting the garrison to the sword, and carrying the inhabitants into captivity; and compelled the emperor to deliver up the cities which he held upon the Black Sea, and become his tributary.

The Ottoman dominions being now in profound peace, Amurath resigned his sceptre into the hands of his son Mahomet, a youth of only fifteen years of age, and retired to Magnesia, a beautiful residence not far from Smyrna. Scarcely, however, had he begun to taste the sweets of retirement, when the restless Caramanians, who had been so often subdued, and as often pardoned, taking advantage of the present juncture, invaded Anatolia. Ladislaus, king of Hungary, also instigated by the pope, and in defiance of a most solemn treaty, passed the Danube with a numerous army composed of various christian nations, and commanded, under the king, by the valiant Huniades. The young sultan, surrounded with enemies, and without experience, yielded to the advice of his counsellors to entreat his father to resume the reins of government, and to defend the throne at this alarming crisis. Amurath reluctantly complied, hastened to Adrianople, and led his troops by forced marches to the shores of the Euxine, where the christian army lay encamped. The battle of Varna deprived Ladislaus of his army and his life, a just retribution, say the Turks, for the violation of his word and oath. The Ottoman monarch shortly after again withdrew from the cares of royalty to his solitude at Magnesia; but the feeble hand of his son was unable to restrain the licentiousness of the janissaries. Adrianople became a prey to domestic faction, and Amurath again resumed the sceptre, which he held until his death. During his latter years he was engaged in constant hostilities with George Castriot, called Scanderbeg by the Turks, the prince of Albania, who had been educated at the court of Adrianople, and had served for many years in the Turkish army; but before the battle of Varna had raised the standard of revolt in his native province, and now commanded the army of the states of Epirus. The valour and experience of Amurath were foiled by the Albanian chief. His mighty army was driven with shame and loss from the walls of Croya, the residence and capital of the Castriots; and for twenty-three years Scanderbeg resisted the undivided force of the Ottoman empire. The Hungarians, under Huniades, were again routed with great slaughter on the plains of Cassova; but the reduction of Albania he left as a legacy to his successor, saying with his dying breath, after urging him to the conquest of Epirus, "Wherefore, my son, thou shalt receive from me this sceptre and these royal ensigns; but above all things, I leave unto you this enemy."

Amurath has received encomiums, both from Greek and Turkish historians. He was a just and valiant prince, moderate in victory, and ever ready to grant peace to the vanquished. He was not only learned himself, but a great encourager of learning and science in others. Strictly religious, he was never known to violate his word, and his charity was liberal and extensive. "Every year," says Cantimir, "he gave 1000 pieces of gold to the sons of the prophet, and sent 2500 to the religious persons at Mecca, Medina, and Jerusalem."

Mahomet II. commenced his reign with the murder of his two infant brothers; and the first object of his ambition was the capture of Constantinople. That city with its suburbs comprised the dominions of Constantine Palœologus, its reigning emperor. Its inhabitants were distracted by religious divisions. Some were anxious for their union with the Romish church, while others declared that they would rather see the turban of Mahomet in the church of St. Sophia than the pope's cap; and when Constantine sent ambassadors to Rome to demand succours, and complete the union of the two churches, the pope, suspecting his sincerity, refused all assistance. The eastern empire was thus abandoned to its fate, and Christendom beheld its fall with indifference.

The site of the city of Constantinople forms an equilateral triangle, having on the south the sea of Marmora, and on the north-east the gulf of Keras, which forms the port or harbour. On the land side it was defended by a double wall and a ditch 100 feet deep, and 200 wide; and the harbour was secured by a strong chain drawn across from the Fair-gate to Galata, and protected by eight large ships. Had this city been garrisoned according to its capability, it might have defied every attempt for its subjugation; but out of 100,000 inhabitants scarcely 5000 could be found willing to man the ramparts in defence of all that was dear to them. These, with a reinforcement of 2000 Latins under John Justinian, a noble Genoese and a skilful warrior, formed its sole defence against 250,000 Moslems, instigated by religious fanaticism and the hopes of plunder. But the heroic valour of Constantine was worthy the best days of Rome, and though almost hopeless of success, he resolved to die in the cause of religion and honour. Anxious, however, to save the lives of his people, and desirous of peace upon any conditions short of the surrender of his capital, he proposed to pay whatever tribute the Moslem might impose. But Mahomet could too well appreciate the situation of Constantinople as the centre of a mighty empire, and his ambition would be satisfied with nothing less. He offered the Morea as an equivalent to the emperor, and to the people a free toleration or a safe departure. Constantine rejected the degrading compromise, and answered with firm resignation and heroic resolution, "My trust is in God alone; if it should please him to mollify your heart, I shall rejoice in the happy change; if he delivers the city into your hands, I submit without a murmur to his holy will. But until the judge of the earth shall pronounce between us, it is my duty to live and die in the defence of my people."

The Turkish army extended from the Propontis to the harbour, and all the genius and valour of Mahomet were employed in the attack; but they were met by the little garrison with equal skill and bravery, and who made such an obstinate resistance that all his efforts on the land side were unavailing. In order, therefore, to make a double attack, and as the barrier to the harbour was impenetrable, he formed the wonderful project of transporting by land his lighter vessels and military stores from the Bosphorus to the higher parts of the harbour. A road was opened behind Galata, through brush-wood and over hills; and seventy gallies, drawn forward by the power of men and pullies, were launched into the shallow waters of the harbour, where the heavy vessels of the Greeks could offer no molestation. Being thus provided with the means of attack against a more vulnerable part of the city, and having opened several breaches in the wall by his enormous cannon, Mahomet prepared his army for a general assault. He inspired his troops by setting before them the joys of paradise if they fell, and the certainty of plunder if they survived. "The city and its buildings I claim for my own; but I resign to your valour the captives and the spoil; and the intrepid soldier who first ascends the wall, will I reward with the government of the fairest and most wealthy province of my empire." The decisive attack commenced at daybreak on the 29th of May 1543. Mahomet on horseback, and with an iron mace in his hand, encouraged his soldiers to enter the breach, which was bravely defended against fearful odds by the emperor and Justinian. The latter being wounded retired from the fight, and Constantine fell in the breach, covered with heaps of slain. His death spread consternation among the Greeks, who fled towards the city, pursued by the victorious Turks, and Constantinople was irretrievably lost to the christians. The sultan, attended by his pachas and guards, passed in triumph through the gate of St. Romanus. The inhabitants were devoted to slavery or ransom, and their treasures became the lawful spoil of the conquerors. All the public buildings were preserved, and the principal churches stripped of their images and ornaments, were transformed into mosques by worship and purifications.

The capture of Constantinople seemed only to whet the appetite of Mahomet for farther dominion, and his ambition grasped at all the territories which formerly owned the first Constantine as their lord. Servia acknowledged his power by an annual tribute; but he was repulsed from Belgrade by John Huniades, with the discomfiture of his army and the destruction of his fleet. In this engagement Mahomet was severely wounded, and carried for dead into his tent; and Huniades survived his victory only about a month.

The defeat before Belgrade did not check, but only made the Ottoman sultan diverge a little from his course, and he turned his arms towards Greece. Demetrius and Thomas, the surviving brothers of the emperor Constantine, held the sovereignty in the Morea; but partly by force and partly by fraud he extinguished the authority of the Paleologi in that country; and the emperor of Trebisond, overcome with terror, resigned, at the first summons, his capital and kingdom into the hands of Mahomet, for which submission he was rewarded by an untimely death.

In Scanderbeg however, the hated enemy of his house, Mahomet found a foe whom neither promises nor threats could detach from his love of national independence, and whose undaunted valour and military skill have stamped him as one of the greatest champions of his time. Year after year the Turkish armies were routed and dispersed in the mountains of Albania. Baffled in every attempt to overcome his enemy by force, Mahomet endeavoured to get rid of Scanderbeg by assassination. This design however, having also failed, he marched in person into Albania, and invested Croya with 200,000 men; but fearing to be disgraced before it as his father Amurath had been, he left Balbanus, one of his pachas, with 80,000 men, to prosecute the siege, and returned to Constantinople. In a sally of the garrison, Balbanus was shot through the neck, which so discouraged the Turks that they deserted their camp, and were afterwards routed with great slaughter. In the following spring Mahomet made a similar but equally fruitless attempt at the subjugation of Croya, but had scarcely reached Constantinople when he received the welcome intelligence of the death of the Albanian prince, who had been carried off by a fever at Lyssa, in the 63d year of his age. So great was the dread with which Scanderbeg had inspired the Turks, that upon the taking of Lyssa about nine years after, his remains were dug up, and happy was the Turkish soldier who could procure a fragment of his bones, which being set in gold or silver, was worn as an amulet, with the superstitious impression that the wearer would inherit the good fortune of its former owner.

Mahomet being now freed from his most formidable foe, overran Epirus and Albania; took from the Venetians the city of Negropont, then the strongest walled town in Europe; wrested the Crimea from the Genoese, and at last invaded Italy, and captured the city of Otranto, which he strongly fortified and victualled for eighteen months, with the intention of prosecuting his conquests in that country. But Italy was saved by the death of Mahomet, who was carried off by a violent fit of the gout, while leading his forces against the king of Persia.

This sultan is renowned for his military talents, and was fortunate in most of his enterprises. His dominion extended over all the provinces which formed the eastern division of the Roman empire in Europe; over the whole of Asia as far as Mount Taurus, and his authority was acknowledged by the Tartars on the north of the Euxine from the Dneister to the Cuban. He received the surname of *fatih* or vanquisher, having subdued, according to the Turkish historians, two empires, twelve kingdoms, and two hundred fortified cities. He was also accomplished in all the learning of his age, and such was his love of justice that he ordered his oldest son Mustapha to be strangled for ravishing the wife of one of his pachas. He was, however, ambitious, implacable, and a dissembler, and endeavoured by every means to perpetuate in the hearts of his subjects a national and religious antipathy to the christians.

Bajazet II. was projecting a pilgrimage to Mecca when he received intelligence of his advancement to the throne. His piety however was proof against the suggestions of worldly policy, and he declared that he would rather forfeit the empire of the whole world than leave his vows unperformed. But he recommended his son *Korkud* as his substitute until his return, which happened about nine months after, when Korkud dutifully resigned the sceptre, and while he led Bajazet to the throne, thus addressed the chief officers of state: "This is indeed my father and lord, but he is also the governor and emperor of the Ottomans. I have hitherto been his shadow; now the light is come the shadow vanishes; to him alone therefore pay obedience and reverence."

The commencement of the reign of Bajazet was disturbed by the pretensions of his brother Djem, who founded his claim to dominion upon his being born the son of an emperor, whereas Bajazet was born before his father Mahomet had obtained the imperial dignity. Prince Djem was one of the most accomplished men of his nation, being endowed with great prudence, magnanimity, and fortitude; skilled in literature and eloquence, and a strict observer of his faith. But his ambitious desire to reign involved him in a series of misfortunes, which terminated only with his life. Upon the death of his father he seized upon Brusa, and caused himself to be proclaimed sultan; but his army was annihilated by the grand vizier Achmet, when he fled to the sultan of Egypt, who received him kindly and supplied him privately with money. After a variety of fortune he took refuge in Italy, where he was at first encouraged in his pretensions by the christian princes; but the gold of Bajazet found admission into the coffers of the Roman pontiff, the infamous Alexander VII., who, it is said, administered poison to his unsuspecting guest.

Bajazet was fortunate in having a general of such bravery and experience as the vizier Achmet. He was the idol of the janissaries, whose turbulence and tumults he alone could control, and who were ever confident of victory when led by their favourite chief. Under his councils and direction, the Ottoman arms were every where successful. Having overran Moldavia, and subjected it to tribute, he penetrated into Cilicia, overthrew the Caremanian prince and his Mameluke auxiliaries on the plain of Tarsus, and established the dominion of Bajazet over the whole sea coast as far as the Syrian gates. But the talents and bravery of Achmet could not screen him from the ingratitude and treachery of his suspicious master; who, jealous of his influence with the janissaries, resolved to destroy him; which he soon after secretly accomplished. By this deed Bajazet cast from under him the firmest pillar of his throne, and exposed himself to the resentment of a fierce and unbridled soldiery, who had begun to feel their influence in the government, and who continued for five centuries to exercise a control in the empire alike destructive of its energies and its happiness.

The Mameluke sovereigns of Egypt had long beheld with jealousy and dread the growing power of the Turks, and had embraced every opportunity of fomenting and encouraging rebellion in their dependencies in Asia Minor. Bajazet, aware of their hostile feelings, was farther incensed against Kaitebey, the sultan of Egypt, for the protection which he afforded to his brother Djem. Both parties were afraid to come to open hostilities; but a rupture was precipitated by the contentions of two petty princes in Asia, when the greater powers, from being auxiliaries, became principals in a war which occasioned much bloodshed in this and the following reign, and which ended in the total overthrow of the Mameluke sovereignty in Egypt.

The invasion of Syria by Bajazet was anticipated by the Mamelukes, who opposed him in the neighbourhood of Mount Taurus; when, after a bloody and arduous conflict, Bajazet was compelled to retire with the loss of two-thirds of his army, and all his baggage and cannon. The Turkish fleet, which accompanied the army, was equally unfortunate, having been wrecked in a storm at the mouth of the river Orontes.

The Mamelukes were originally Circassian slaves, who had been trained to arms by the sovereigns of Egypt, and formed the choicest troops of that country. They were annually recruited from the land of their birth, and by degrees grew so formidable to their masters, that they became the dispensers of the sceptre of Egypt. Having at last set aside the reigning dynasty, they raised one of their own nation to the throne; and the Mameluke rule over this fine country continued for more than a century. Bajazet saw the difficulty of subverting a power whose reinforcements were almost exhaustless, and therefore determined to cut off their supplies by reducing the province of Circassia. With this view he entered into a treaty with the sultan of Egypt, by which he restored the conquests which he had made two years before in Cilicia, and then led his army into Circassia. The reduction of this country occupied the Turkish arms nearly seven years, when Bajazet established a line of posts from Erserum to Derbend on the Caspian, by which he completely prevented the emigration of the inhabitants. Kaite-bey, the reigning sovereign of Egypt, was so afflicted by this intelligence, that he is said to have died of grief, well knowing that the Mamelukes, when deprived of reinforcements from their native country, could not long withstand the Turkish power.

Bajazet, however, adopted no ulterior measures with respect to Egypt. His attention was called to the Venetians, with whom grounds of quarrel respecting their commercial rights were constantly occurring. Their fleets met at Sapienza in the Archipelago, when the Venetians were defeated with great loss; and the victors, in consequence, became masters of Lepanto and Modon. The Turks at the same time invaded and ravaged Friuli in Italy, whence they carried off many captives and much spoil; but they received a severe check from Gonsalvo the famous Cid, who had come to the assistance of the Venetians, and who, having captured Cephalonia and Sta Maura, drove the Turkish fleet into the Hellespont, and destroyed several of their ships. A peace was soon after concluded, when Sta Maura was restored to the Turks, who also kept possession of the city of Durazzo in Albania. It was when upon this expedition to Albania, according to Knolles, that Bajazet had nearly fallen under the hands of an assassin. A dervise, approaching in the attitude of beseeching alms, made a blow at the sultan with a short scymitar, which would have been fatal had not his horse by starting aside saved the life of his master. The blow was about to be repeated, when the assassin was hewn to pieces by the Ottoman attendants.

Bajazet, being now at peace with all his neighbours, began to taste the sweets of repose, and to devote himself to the study of the religious and philosophical literature of Islamism. He was scarcely interrupted by the rebellion of *Scheitan Kuli*, the founder of the Soffee sect of Mahometan heretics. This impostor had acquired a character for sanctity by the austerities of his life and his retirement from the world in a secret cave, and had collected such a number of followers, that, not contented with attempting the conversion of his countrymen, he proceeded to take up arms, and to revolutionise the state. Having seized upon *Kutaia*, he defeated the troops of Bajazet in several engagements; but was at last overpowered by the vizier, and flying into Persia, converted to his opinions the sovereign of that country and most of his subjects.

While Bajazet was indulging his love of retirement, and contemplating measures for his complete abandonment of the cares of royalty, by raising his son Achmet to the throne, his youngest son Selim, supported by the turbulent janissaries, snatched the sceptre from his grasp, and followed up his unnatural rebellion by the murder of his father.

Bajazet, though averse to war, was in general a successful soldier, and both extended and consolidated the Ottoman dominions. He was a zealous promoter of literature and the arts, and was himself an accomplished scholar; but he was chiefly distinguished for his piety and benevolence, being profuse in his charities, and superstitiously observant of the precepts of the prophet.

Selim, eager to relieve himself of every competitor to the throne, devoted to death all his brothers and nephews. Fierce and cruel in his disposition, he was well inclined to indulge to the full his impatient and fiery janissaries in their love of conquest and plunder.

Ishmael, the shah of Persia, had adopted the heresies of the impostor Schietan, and had destroyed throughout his kingdom the mosques of the Sunnites, who are regarded by the Turks as the only orthodox believers. Thus religious animosity, mingled with personal jealousy and national aggrandisement, hurried on a contest between two of the most renowned and powerful sovereigns of Islamism, which continued to be prosecuted for two centuries with the bitter feelings of sectarian rancour and zeal.

Selim having assembled a mighty army on the plains of Erzerum, crossed the mountainous deserts of Ararat, where his troops were subjected to great suffering and privations, and where in all likelihood he would have been sacrificed to their resentment, had not the appearance of the Persian forces, glittering with gold and precious stones, and attended by numerous beasts of burden, excited the cupidity and courage of his janissaries. The two armies met on the plains of Chalderon, and after a long and obstiinate engagement the Turks obtained the victory; but so dearly was it bought that they called it "the day of judgment." An immense booty and the city of Tauris fell into the hands of the Ottomans; but their retreat was sudden and disastrous, and Selim with difficulty rescued the relics of his army from the harassing attacks of the Kurdish mountaineers.

Selim again prepared for the invasion of Persia by subjugating Armenia, Diarbekir, Kurdistan, and the vast peninsula between the Euphrates and the Tigris. By these important conquests he opened an easy access into the dominions of Ishmael; but he dreaded to leave the sultan of Egypt behind him, and, having vainly endeavoured to detach that prince from his alliance with Persia, he advanced into Syria and encamped on the plains of Aleppo. The Mamelukes, led by sultan Kansu Ghauri, hastened to the combat, and charged with such intrepidity that the Turks, being driven back, were on the eve of being overthrown, when they were saved by the treachery of the governor of Aleppo, who deserted from the enemy. Selim was thus enabled to rally his forces and to bring his artillery into action, which made great havoc among the Mameluke squadrons. These brave troops however for a time maintained their ground, but were at last compelled to retire with the loss of their sultan, who fell in the engagement. The Ottoman army marched without opposition to Cairo, when, after another obstinate but decisive encounter, the power of the Mamelukes was annihilated, and Toman-beg, the new sultan, was some time after taken and hanged at one of the gates of Cairo by the inexorable Selim.

Selim established the government of Egypt in twenty-four beys, whose authority he subjected to a council of regency, supported by a standing army of 20,000 infantry and 12,000 cavalry. Syria and Palestine were converted into Ottoman pachaliks; the scheriff of Mecca proffered to him the keys of the holy city; and the Arabs of the desert submitted to his sovereign authority.* On his return an ambassador from Persia met him at Aleppo, and endeavoured by presents and flattery to avert his hostility to his master; but Selim, in the pride of conquest, swore that he would subvert the Persian empire, and extinguish a race odious to God and man. Persia however was saved by the death of Selim, who died of an impostume in his thigh, after forty days of severe suffering.

Selim was one of the ablest and most successful generals of his time, and during his short reign, added more territory to the Ottoman empire than any of his predecessors. His sanguinary disposition obtained for him the appellation of *Yavus* or cruel. His slightest displeasure was followed by death, and neither fidelity nor services could avert the tyrannical mandate.† But while his character was marked by many revolting cruelties, both towards his family and his subjects, he was distinguished for his attainments in the literature and philosophy of his age. The following inscription in Arabic verse, composed by himself, and placed upon the pavilion of the Nilometre, which he constructed and embellished, testify his genius and his piety. "All the riches and the possessions of men belong to God, who alone disposes of them according to his will. He overturns the throne of the conqueror, and scatters the treasures of the lords of the Nile. If man could claim as his own the smallest particle of matter, the sovereignty of the world would be divided between God and his creature."

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* Selim brought with him from Damascus the last caliph of the house of Abbas, by whose resignation he obtained for the Ottoman sultans the title of caliph, so important in the eyes of Mussulmans, and which confers the highest spiritual influence and supremacy.

† When Selim first prepared for war, his vizier inquired in what quarter he should erect his tents, for which he was instantly strangled. His successor repeated the same question, and met with the same fate; but the third pitched the tents to-

Soliman commenced his reign under very favourable circumstances. The conquest of Egypt and the submission of Persia enabled him to direct his whole disposable force against the christians; and an insult offered to his ambassador at the court of Hungary, furnished him with a pretext for immediate operations. He sat down before Belgrade with a large army, and this city, which was the bulwark of Hungary, and had so often successfully repelled the assaults of his predecessors, surrendered, it is supposed through treachery, after a short siege of four weeks. This important capture opened to him a passage into the heart of Hungary; and had he been enabled to prosecute his success, and to take advantage of the divisions which then agitated christendom, he might have planted the crescent on the walls of Vienna. But as the Ottoman armies were composed principally of persons holding military fiefs, who were bound only for a limited term of service, and who were averse to remain after its expiration, Soliman was compelled to return to Constantinople.

Instead of opening the succeeding campaign on the Danube, Soliman directed his efforts against the knights of St. John, in the island of Rhodes. This institution was the avowed enemy of the Ottoman power, and was acknowledged to be the chief defence of Italy against the fleets and armies of the Turks. In its last struggle, however, it received no assistance from the princes of Europe, and Venice even was in league with the Porte. It stood single-handed against the most fearful odds; and after a siege of six months, unexampled in that age for the military skill and determined valour displayed on both sides, it submitted to an honourable capitulation.

Soliman having restored tranquillity to Egypt, which had been distracted by the rebellion of his pachas, again turned his steps towards Hungary, which, during a long life, continued to be the principal scene of his triumphs and his shame. Twenty-five thousand Hungarians, under their young king Lewis, opposed themselves, at Mohatz, to 200,000 Ottomans. Their rashness was severely punished, for few of them escaped from this fatal field; and Lewis, with many of his prelates and nobles, fell in the engagement or pursuit. Buda, the capital, opened its gates to the conqueror, and the whole kingdom was now at the mercy of Soliman; but after ravaging the country, and carrying off many captives, he retired with his army to Adrianople.

An insurrection in Anatolia, which at one time threatened to separate that province from the empire, detained Soliman for three years from prosecuting his conquests in Europe; and during that period Buda was retaken by the Hungarians. At the same time Hungary was distracted by a disputed succession between John Zapoli, waywode of Transylvania, and Ferdinand, archduke of Austria. Zapoli, unable to cope with the power of his rival, sought the protection of the Turkish sultan, and offered to hold the kingdom as a fief of the Ottoman crown. Soliman gladly accepted his submission, and now proceeded to Hungary, under the pretence of recovering the kingdom in behalf of his vassal. Buda surrendered at his approach, and the garrison was put to the sword. The principal fortresses on the Danube also yielded almost without opposition, and he sat down before Vienna with an army whose tents covered a space of six miles. Thirty days spent in almost continued assaults, and the loss of 80,000 of his bravest troops, proved the strength of the fortress, and the approach of winter warned Soliman of his danger, and compelled him to retire with vexation and disgrace from before the Austrian capital.

Exasperated by the dishonour done to his arms, Soliman prepared an immense armament for another campaign. With an overwhelming force of 500,000 men, he marched without opposition to the confines of Germany, when he was stopt by the small fortress of Guntz. The emperor Charles V. awaited his approach under the walls of Vienna, but the boasting Ottoman shrunk from the contest; and after laying waste the open country, he hastily retired to Constantinople, leading with him a miserable train of 30,000 captives, the sole fruits of all his pompous preparations.

To repair his disgrace, Soliman turned his armies against Persia, and advancing to Tauris, awaited the approach of the enemy. But Shah Tamasp, aware of his inferiority in the field, confined himself to defensive measures, and having laid waste the country on all sides, retired with a powerful body of cavalry, and watched every step of his formidable opponent. The Turks became dispirited by the inclemency of the weather, and Soliman vented his revenge upon the unfortunate city of Tauris, which he ordered to be sacked. The Persian monarch, though unseen, was not far distant, and while the Turks were scattered in disorder over the country in quest of plunder, he fell upon them with his cavalry at midnight, set fire to their camp, and retired before break of day, loaded with spoil and numerous captives. Soliman, after

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wards the four points of the compass; and when the sultan demanded where his camp was fixed, "Every where," said the subtle vizier, "thy soldiers will follow thee wherever thou shalt lead." "Behold," said the tyrant, "how the death of two has procured me a capable vizier." Upon another occasion, when on his march to Cairo, one of his officers presumed to ask him when they should enter a certain village, "When God pleases," said the sultan, "but for thee, it is my pleasure that thou stay here," and immediately ordered his head to be struck off.

two years, led back his discomfited army with the loss of 200,000 of his troops. But though this campaign was disastrous to the army of Soliman, it was nevertheless accompanied by a very important conquest, the opulent city of Bagdad and its dependencies, which he converted into a Turkish province, and which continues to be the eastern bulwark of the empire. His high admiral, the famous Barbarossa, also added to his territories, by the conquest of the Cyclades from the Venetians, and his fleet rode triumphant in the Ionian sea.

Hungary again attracted the attention of Soliman. The infant son of John Zapoli had been recognised upon the death of his father by the greatest part of the Hungarian nobility, and was crowned at Buda under the name of Stephen; and when Ferdinand disputed his claim, the queen appealed to Soliman for assistance in behalf of his vassal. The wily Ottoman attempted no longer to rescue the kingdom by force, but by a base and insidious policy, he seized upon Buda, transferred the queen and her son to Transylvania, and constituted Hungary a *beylerbelik* of the Ottoman empire, converting its churches into mosques, and ordaining justice to be administered in his own name. This unhappy country continued to be so torn and exhausted by conflicting pretensions, that Soliman at last resolved to secure by force what he had obtained by fraud, and to compel the submission of the emperor Maximilian, who had succeeded his father Ferdinand. He surrounded the city of Zigeth, which had been besieged by one of his pachas with 150,000 men and 100 pieces of cannon; but Count Serino, its brave defender, repelled every assault with such determined resolution, that Soliman, overwhelmed with vexation, was carried off by a fit of apoplexy. His death was concealed from his troops, who continued to press the siege, but a magazine having taken fire, compelled Serino and his little band to leave the fortress and cut their way through the Turkish camp. They rushed into the midst of the enemy, and after causing great slaughter, were surrounded and cut to pieces.

The Ottoman court under Soliman exhibited a degree of splendour and magnificence far removed from the stern and bigoted habits of its former masters; and both as an enlightened sovereign and a munificent patron of literature, he held a distinguished rank among the cotemporary princes of Europe. His first act upon coming to the throne, marked the justice and nobleness of his character. He proclaimed throughout the empire, that whoever had been unjustly aggrieved, either by the sultan his father, or by his ministers, should be indemnified out of the imperial treasury. His military achievements, both in splendour and importance, were far surpassed by those of his father Selim; and he is greatly indebted for his renown as a conqueror to the naval victories of his admiral Barbarossa. His fame among his countrymen, however, chiefly rests upon his judgment and wisdom as a legislator, and for which he received the surname of *Canuni* or instituter of rules, and his *canonameh* or imperial code still holds a prominent place in the jurisprudence of the nation.[*] Soliman has been termed the glory of the Ottoman empire; but with him its glory departed. For while the current of civilization and improvement had set in among the nations of western Europe, it was repelled by the barrier of Ottoman pride. The persuasion of his countrymen, that the institutions of Soliman were perfect, and his regulations respecting the princes of the blood, who before his reign were trained to war and business, by having the command of armies and provinces, but were now confined to retirement and obscurity, are the principal causes from which may be traced the decline of the Turkish empire, which, after the reign of Soliman, continued no longer to be the terror of christendom.

The councils of SELIM II. continued for a time to keep the impress of his father's energies; and though he did not assume in person the command of his armies, they were still directed by those able generals who were bred under the auspices of Soliman. The janissaries, whose mutinous and ferocious disposition could only be curbed by the hand of a vigorous master, required immediate employment, and as no cause of quarrel existed with the emperor Maximilian, who had transmitted his arrears of tribute, their efforts were directed against their old enemies the Persians. But as the mountainous and desert barrier of Persia had been fatal to so many armies, the grand vizier conceived the noble project of uniting the Don with the Wolga by a navigable canal, and thus forming an easy access into Persia by the Caspian. This splendid enterprise, worthy of the enlightened genius of more modern times, was however interrupted by the attacks of the Russians, who upon this occasion, for the first time, became known to their invaders, and was afterwards abandoned by the superstitious Ottomans.[†]

The vexation of Selim at the failure of this expedition, was diverted by his resolution to wrest from the Venetians the island of Cyprus, which, after a brave and protracted defence, yielded to his arms. Famagusta, its strongest fortress, had been intrusted to Bragandino, whose undaunted bravery and skill prolonged the defence; but exhausted by famine, and all hope of succour being extinguished, he capitulated upon condition of being allowed to depart in safety. This stipulation, however, was instantly violated by the perfidious Turk, and the brave Bragandino, after being exposed to insults and tortures, was inhumanly flayed alive, and his skin, stuffed with straw, was hung at the yard-arm of a Turkish galley.

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[*] "He caused a compilation to be made of all the maxims and regulations of his predecessors on subjects of political and military economy. He strictly defined the duties, the powers, and the privileges of all governors, commanders, and public functionaries. He regulated the levies, the services, the equipment, and the pay of the military and maritime forces of the empire. He prescribed the mode of collecting and of applying the public revenue. He assigned to every officer his rank at court, in the city, and in the army; and the observance of his regulations was imposed on his successors by the sanction of his authority. The work which his ancestors had begun, and which his care had completed, seemed to himself and his cotemporaries the compendium of human wisdom. Soliman contemplated it with the fondness of a parent, and conceiving it not to be susceptible of further improvement, he endeavoured to secure its perpetual duration."—*Thornton.*

[†] It was artfully suggested, that the higher latitudes are interdicted to Mussulmans, because the shortness of the nights in summer prevents their observance of the precepts of their religion.

Europe looked on with apathy during these proceedings, but no sooner was Cyprus lost than the christian states became alarmed, and entered into a league for mutual defence. Their fleets, commanded by Don John of Austria, repaid the perfidy of the Turks by the total destruction of their navy in the gulf of Lepanto; and this splendid victory, while it filled the Ottomans with dismay, animated the Venetians with the hope of the re-conquest of Cyprus. Its results, however, were far inadequate to the glorious fruits which it promised. The maritime strength of Turkey was regenerated by the talents and valour of the high admiral Kilig Ali, who put to sea with his new fleet, and braved the forces of the confederates upon their own coast. Philip II., the chief of the confederates, withdrew his squadrons, and the Venetians were compelled to make peace, with the loss of Cyprus and part of Dalmatia.

An insurrection which broke out in Moldavia was speedily quelled, and Algiers, Tripoli, and Tunis, having acknowledged the supremacy of the Ottoman porte, Selim contemplated the reduction of Malta, when he was carried off by a fever, in the ninth year of his reign. This prince possessed none of the martial and energetic qualities of his father; but overcome by indolence and superstition, he devoted himself to wine and pleasure. Worn out by early intemperance and debauchery, he became a prey to superstitious fears, which so affected his mind, that a morbid melancholy shortened his life.

AMURATH III. secured his advancement by the now established practice of devoting to death all the other males of the deceased sultan's family. This prince was even more superstitious than his father; and every action of his reign was prompted and regulated by the reveries of astrology. He timidly yielded to every demand of the mutinous janissaries; but relieved the capital of their presence by a Persian war, which continued to occupy his armies and to exhaust his treasures for nearly twelve years. Having afterwards directed their enthusiasm in defence of the Hungarian provinces, Amurath himself was induced, by the solicitations of his vizier, to place his foot in the stirrup; but his wavering mind was so overcome with terror during a violent tempest, that he shut himself in the seraglio, and fell a victim to his own gloomy and imaginary fears.*

The Hungarian war continued throughout the reigns of his successors MAHOMET III. and ACHMET I., and was concluded by the treaty of Comorra in 1616. The Ottoman empire, during this period, seemed fast hastening to decay. Its feeble-minded monarchs had become the slaves of the turbulent soldiery, and the rich provinces of Anatolia were desolated by rebellions. Its treasury was exhausted, and its armies were consumed in the swamps of Hungary, or in the arid sands of Persia. Surrounded by formidable enemies, and torn by intestine divisions, it was stripped of all its conquests on the side of Persia by Shah Abbas the Great; and the empire was saved more by the clemency of the conqueror than by its own power of resistance.

The imbecile MUSTAPHA occupied the throne for a few months, and was deposed to make room for OTHMAN II. This prince, had he possessed prudence and experience, was endowed with qualities that might have enabled him to revive the glories of the reign of Soliman; but his pride and severity excited against him the hatred of the janissaries, and his ambition and obstinacy hurried him into a war with Poland, contrary to the advice of his wisest counsellors. He led an army of 400,000 Turks to the banks of the Dneister, and after having seven times assaulted the Polish camp with the most determined courage and perseverance, he was compelled to retire in disgrace with his discomfited and discontented troops. A revolt of the janissaries immediately followed, in which Othman was deposed and strangled, and Mustapha again raised to the throne. This stupid prince enjoyed the pageant of royalty only for a short period, when the sceptre was placed in the hands of AMURATH IV.

The first years of his reign were devoted by Amurath, to repress the insolence and rapacity of the janissaries, who had now adopted the system of commanding their sovereigns, and of raising whom they pleased to the throne. These lawless soldiery had murdered the *kaimaken* or lieutenant of the grand vizier, in the presence of the sultan. Amurath marked the deed in silence, but watched his opportunity of revenge. The most seditious were arrested, and privately executed; detachments were from time to time sent off to the army on the frontiers; and when their numbers in the capital were thus no longer formidable, Amurath issued an order for their destruction. This order was accompanied by a *fetva* of the mufti, enjoining the inhabitants of Constantinople and other principal cities to take up arms, and slay every janissary within their walls. The order was rigorously obeyed, and this once powerful body were reduced to such weakness that they became incapable of any seditious movement during the whole of this prince's reign.

The Ottoman porte at this period was engaged in hostilities on every side; but the thirty years' war, which now broke out in Europe, relieved Amurath from all apprehensions on the side of christendom. He therefore directed the strength of his empire against Bagdat, which had been reduced by the Persians. Three hundred thousand Ottomans surrounded the devoted city: thirty days it withstood their incessant assaults, but it fell by the treachery of the governor, and was given up to massacre and pillage. The bloody mandate was in process of being executed, when Shah Cali, the Orpheus of Persia, presented himself before Amurath, and sung to the *Scheschader* the downfall and misery of his native city with such intense and touching enthusiasm, that the conqueror was melted to tears, and commanded the slaughter to be suspended. Amurath led back his army loaded with plunder, and made a triumphant entry into his capital; but he did not long survive this important capture, being carried off by a fever, the consequence of a deep debauch, in the 31st year of his age.

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* It was under this prince's government that England was first admitted to the privileges of a free trade; and the ambassador of Elizabeth was received with distinction at the court of Constantinople.

Amurath possessed great endowments both of body and mind. His bravery and skill in war obtained him the surname of *Gazi*, or conqueror, and his energy and steadiness of purpose ensured the internal tranquillity of his empire, which, during the former reigns, had been so frequently disturbed by the arrogance and outrages of the janissaries. Of all his army none could excel him in handling the bow, or wielding the scymitar, or were so expert in managing his horse, and throwing the *jerid*. His great endowments, however, were obscured by licentiousness and cruelty. The slightest act of disobedience was punished with death, which he often executed with his own hand; and so fond was he of shedding blood, that he is said to have sometimes sallied out of his palace at midnight with a drawn sword, and put to death any unfortunate person whom he chanced to meet. He was early addicted to an excessive indulgence in wine, which continued through life, and brought him at last to a premature grave.

The sceptre, which had been grasped by the fierce and imperious Amurath, fell into the hands of the timid and feeble **Ibrahim**, as the only surviving male of the house of Othman. Indolent and effeminate, he resigned himself entirely to the pleasures of the harem, and left the direction of affairs to the grand vizier Mustapha, the favourite of Amurath. Mustapha overawed the refractory soldiers by severe discipline, cut off some of the pachas whom he suspected of seditious purposes, and by such means infused into the government of Ibrahim the energy and decision of its former master. He cleared the Euxine of the Cossack pirates, and expelled them from the city of Azoff; but he soon after fell a sacrifice to the resentment of Kiosem, the validé sultana, whose influence predominated within the walls of the seraglio. The Ottoman arms were then directed against Candia; and the invasion of that island by 74,000 Turks showed to the Venetians that their dominion would no longer be tolerated in the Egean sea. Canea and Retimo, two of the principal cities of Crete, after a brave and sanguinary defence, opened their gates; and the whole island submitted to the Turks, except the capital Candia, which alone owned the authority of Venice. In the mean time Ibrahim had rendered himself obnoxious to all classes of his subjects by his open and voluptuous sensuality; and in an insurrection of the janissaries, instigated by the mufti, whose daughter he had defloured, he was deposed, and soon after put to death.

Mahomet IV. was only seven years old when he was called to represent the majesty of the Turks, and his youth was spent amid the broils of faction in the capital, and the commotions of revolt in the provinces. The validé sultana Kiosem first seized the reins of government, but the mother of Mahomet trembled for the fate of her son, and having gained over the vizier Siaus Pacha, Kiosem was put to death. Siaus in his turn fell in an insurrection of the spahis, when Mahomet Kuprili, at the age of eighty, was raised to the viziriat. This minister, having prevailed upon the sultan to remove his court to Adrianople, by firm and vigorous measures restored tranquillity to the capital. He was preparing to lead an army into Hungary when he was seized with a fatal disorder, and on his death-bed he recommended to his master his son Achmet as his successor.

Achmet Kuprili prosecuted the Hungarian war for two years with various success; but being at last opposed by the famous Montecuculi, he was overthrown with great slaughter on the banks of the Raab. So anxious, however, were the Germans for peace, that Kuprili obtained by negotiation what he failed to accomplish by war; and the advantages of the treaty were all on the side of the Ottomans.

The siege of Candia, protracted for twenty years, had now sunk into a regular blockade. The Venetians continued to maintain their ascendency by sea, which enabled them to convey succours to the garrison, while, at the same time, they obstructed the Turkish reinforcements and supplies. Kuprili, anxious to terminate the siege, directed against this city all the resources of the Ottoman power; but every assault was met with the most heroic resistance. No effort, however, of valour or of art could avert its fall; and after twenty-nine months of almost incessant fighting, the Candiots obtained an honourable capitulation, which formed the basis of a peace with the Venetians.

A war with Poland was precipitated by the revolt of the Cossacks of the Ukraine, who sought the protection of the Porte. Mahomet headed his army in person, took the city of Kaminiek, and reduced the whole of Podolia. But in the following year, he was defeated by John Sobieski, and would have been driven from his new conquest, had not the death of the king of Poland recalled the Polish general to Warsaw to assist at the election of a new sovereign. Sobieski was himself the fortunate candidate; but the internal dissentions of his kingdom compelled him to make peace, and resign Podolia to the Turks. The Ukraine Cossacks, however, resenting the haughtiness which they experienced from their new masters, transferred their allegiance to Russia, and, by the assistance of that power, they defeated the Ottoman armies, and relieved themselves from the authority of the Porte.

With the loss of the Ukraine Mahomet had also to lament the death of his favourite vizier Achmet Kuprili, who was one of the most enlightened and able statesmen that ever directed the Ottoman councils. His successor, Cara Mustapha, a man of talents and experience, but over confident and ambitious, was immediately called to the arduous duty of conducting the Hungarian war. Emeric Tekeli had raised the standard of independence in Upper Hungary, and solicited the assistance of the Porte.

Mustapha, rejecting the advice of Tekeli and his wisest officers, and trusting to his powerful resources, hastened to the siege of Vienna with 200,000 Ottomans. His sudden appearance struck such a panic into the Austrians, that the emperor and his court, with 60,000 of the inhabitants, hastily retired from the capital. Mustapha at first pressed the siege with such vigour, that a short time must have decided the fall of Vienna; but the ambitious vizier contemplated the more aspiring project of conquering an empire for himself, and was therefore unwilling that the spoil of the vanquished city should be shared by his barbarous followers. Intoxicated with this mighty design, and confident of success, he delayed day after day making the final assault. The breaches were assailed, but with forces totally inadequate for the purpose. The enthusiasm of his troops was thus allowed to evaporate in vain efforts. Discontent and discouragement spread through the Ottoman camp; and while Mustapha was thus securely dreaming of his new kingdom, the Germans and Poles led by Sobieski descended like a torrent from the mountains. The Turks scarcely made a show of resistance, but fled in disorder, and stopt not for nourishment or rest until they reached the banks of the Raab, a march of fifty hours. At Belgrade, Mustapha received the sultan's mandate of death, and submissively assisted in applying the bow-string to his own neck. The battle of Vienna was followed by a series of defeats and disasters. Their strongest fortresses fell in succession; Buda was taken by storm: and the battle of Mohatz decided the fate of Hungary and Transylvania, which henceforth became subject to the house of Austria. These reverses spread consternation throughout the empire, and the alarmed populace, excited by the ulema and tumultuous janissaries, charged their misfortunes upon the head of the unfortunate sultan. Mahomet endeavoured to pacify the insurgents by the death of the new vizier, and some of his faithful servants; but his deposition was determined upon, and the sceptre was forced upon his brother SOLIMAN II., who would rather have preferred a life of austerity and devotion.

Mahomet was a prince of considerable energy and judgment; but the affairs of his empire were neglected for the pleasures of the chase, to which he was ardently devoted. He survived the loss of his authority about four years, which he dragged out in grief and confinement.

The Ottoman empire was now bowing under an accumulation of evils; a weak and credulous monarch, an infuriated soldiery and discontented populace, and a powerful and persevering enemy. Soliman endeavoured to avert the calamities which threatened to overwhelm him by public prayers and rigorous fasts. The Germans, however, continued to advance, and Belgrade was taken by assault. The sultan was compelled to sue for peace, but the demands of the allies were too humbling to be complied with. Another campaign was therefore resolved upon, and Soliman announced his intention of taking the field in person. He proceeded as far as Sophia; but, alarmed by the new successes of the enemy, he deputed the command to Ragib Pacha, who even surpassed his master in credulity and superstition. This commander allowed his councils to be directed by the ravings of a favourite astrologer, who continually promised him victory. His army, however, was routed by the Prince of Baden on the banks of the Morawa; the remains of it cut to pieces on the field of Nissa; and the conqueror advanced to the neighbourhood of Sophia. The Porte was about to yield to the degrading conditions of the emperor, when Mustapha, the son of the renowned Achmet Kuprili, saved the honour of his master, and restored a transient lustre to the Ottoman arms. By firm and judicious measures, he renovated the powers of the state; and the drooping courage of the army was revived by their confidence in his military skill. Kuprili commenced his career of victory by the reduction of Nissa. Belgrade, with the strong fortresses of Lippa and Arsova, yielded to his valour; and he returned in triumph to Adrianople to be welcomed by his grateful sovereign.

Soliman survived the success of his arms only a few months, and was succeeded by his brother ACHMET II. This prince was equally weak and credulous as his predecessor, and would have sacrificed his distinguished vizier to the jealousies and cabals of the seraglio, had not the wisdom of Kuprili, supported by the affections of the army, disconcerted the plans of his enemies. But the talents of Kuprili were not long destined to support the tottering throne of Achmet. While engaged in a murderous conflict with the Prince of Baden on the banks of the Danube, he was struck with a musket ball in the moment of victory. His troops, overcome with a sudden panic, abandoned their ranks, and suffered a terrible defeat. The loss of the strong arm of Kuprili was a greater disaster to the Ottoman empire than the destruction of its army; and would have been severely felt, had not the Prince of Baden been recalled to the Rhine, when the Hungarian war was confined to petty skirmishes, and continued to languish during the remainder of the reign of Achmet.

MUSTAPHA II., the son of Mahomet IV., upon his accession to the throne, adopted rigorous measures of reform throughout the empire. He summoned to his councils some of the able and experienced pachas who had been driven to retirement by the intrigues and cupidity of the favourites of Achmet; and he endeavoured to reanimate the military spirit of his subjects, by directing in person the Hungarian war. During two campaigns, he maintained against the Elector of Saxony the honour of the Ottoman arms; but he was at last defeated by Prince Eugene at the battle of Zenta, with the loss of fifteen pachas of the highest rank, and two-thirds of his bravest troops. Mustapha escaped from the field in disguise, and was so overcome with grief and disappointment, that he submitted to sue for peace. The treaty of Carlowitz included all the belligerents. It ceded to the emperor, Hungary, Transylvania, and Esclavonia, with the exception of the Bannat of Temeswar; Podolia, the Ukraine, and Kaminiek were restored to the Poles; the Russians retained Azoff; and the Venetians the Morea.

These hard terms excited universal murmurs among the Turkish populace, and withdrew from the unfortunate sultan that confidence and respect with which he had formerly been regarded. His fall, however, was precipitated by the dissensions of the mufti and the grand vizier, Mustapha Daltaban. This minister was a favourite with the soldiery and the people; and his death, which was accomplished through the intrigues of the mufti, produced a general insurrection. The mufti and his family were the first victims; and the sultan Mustapha was compelled to relinquish the throne in favour of his brother ACHMET III.

The war of the Spanish succession, which occupied all the great powers of Europe, enabled Achmet to devote his attention to the internal affairs of his empire. He exacted a severe retribution from those pachas and janissaries who had been engaged in the last revolt; and within the space of five months, 14,000 victims were silently disposed of without any public alarm. Though eagerly solicited by France to make a diversion on the side of Hungary, and though the Russian Czar was continually evincing a spirit of hostility by encroaching on the Turkish frontier, and by building forts on the Don and the Dnieper, Achmet maintained inviolate the treaty of Carlowitz.

The Ottoman dominions were thus enjoying profound peace, when the battle of Pultowa threw Charles II. of Sweden upon the protection and hospitality of the Sublime Porte. This monarch took up his residence at Bender, and was incessant in his endeavours to hasten a rupture with Russia. Achmet was proof against his intrigues, till the public mind was inflamed, and hostilities precipitated by the appearance of a Russian squadron in the Propontis, bearing an envoy of the czar to the Ottoman court. This violation of the Bosphorus would admit of no extenuation, and war was inevitable. The czar Peter crossed the Pruth with a large army, and incautiously penetrating into Moldavia, at a distance from his resources, he was surrounded by the Ottoman army in an angle of the Pruth, near Falczi. Cut off from all supplies, and suffering from the want of food and forage, the czar was meditating the desperate attempt of opening a retreat sword in hand through the enemy's camp, when the czarina suggested the project of a pacification. This was assented to by the Turkish vizier, and Peter was relieved from his perilous situation by the restoration of Azoff and its dependencies, the demolition of the fortresses on the confines of Tartary, and the enlarging and strengthening the Ottoman frontiers.

The abandonment of the Morea to the republic of Venice at the peace of Carlowitz had sorely galled the pride of the Ottomans; and its recovery, therefore, was an object that could not be long neglected. In one short campaign the Venetians were dispossessed of all their fortresses within the peninsula, and also the places which they had retained in Candia. The interposition of the emperor Charles VII. as the guarantee of the treaty of Carlowitz was rejected by the Porte, which hastened another Hungarian war. The hostile armies met in the vicinity of Peterwaradin, and the defeat of the Turks by Prince Eugene was followed by the reduction of Temeswar. The following campaign was equally disastrous. The Ottomans were routed with great slaughter before Belgrade, and that city was surrendered to the victor. Achmet, alarmed by these defeats, eagerly solicited peace, by which he was allowed to retain the Morea in exchange for the fortresses of Temeswar and Belgrade.

Taking advantage of the troubles which agitated Persia during the Afghan usurpation, Achmet seized upon Georgia, Armenia, and the mountainous parts of Tauris as far as the lake Ourmia, while Russia also made important conquests on the shores of the Caspian. Nadir Shah, however, having expelled the Afghans, stript the Turks, during this and the following reign, of all their acquisitions on the side of Persia, and restored the original boundaries of the two nations.

In an insurrection of the janissaries the sceptre was transferred from Achmet to his nephew MAHMOUD I. The new sovereign, however, took a severe retribution upon the insurgent leaders who had raised him to the throne; and to prevent future revolts, made it a rule of his policy frequently to change his vizier, and never to retain any one above three years. The Persian war was prosecuted by the Turkish commander Osman with great ability and success. He twice vanquished Nadir Shah with great slaughter, and, had he been furnished with the necessary supplies by his sovereign, he would have compelled the proud Nadir to retire within his frontiers. But Osman was thrown upon his own resources, and being slain in battle, the tide of victory ran in favour of the Persians, which disposed the Porte to listen to pacific overtures.

Peace was accelerated by the threatening attitude of Russia, and war was commenced by that power by the irruption of Marshal Munich into the Crimea. The emperor offered himself as mediator, but, actuated by a selfish policy, he soon after joined his pretentions to those of the empress Anne. The Turks, led by the counsels of the Count de Bonneval, drove the Austrians from Wallachia and Servia, and laid siege to Belgrade. The emperor paid for his perfidy with the loss of this important fortress; and the Danube and the Save became again the common boundary of the two empires. Russia, though successful during the war, consented to restore her conquests, to demolish the fortress of Azoff, and to relinquish the navigation of the Black Sea.

During the war of the Pragmatic sanction which occupied the principal powers of Europe, the Sublime Porte preserved a dignified neutrality, and instead of taking advantage of the dissentions of his enemies, he proferred to the belligerents his good offices as a mediator. But the treaty of Aix-la-Chapelle restored for a time tranquillity to Europe.

The Russians continued to press upon the desert frontiers of the empire, between the Dneister and Dnieper, by silent but gradual encroachments. Colonies were established and towns arose, and the remonstrances of Mahmoud had only the effect of causing a temporary suspension of these hostile measures.

The latter years of Mahmoud were disturbed by some popular insurrections, excited by the avarice and ambition of his Kislar-aga, which could only be quelled by the death of the favourite and his criminal agents. The sultan himself soon after died in consequence of a fistula, which had been neglected or unskilfully treated; and his death was universally regretted by his subjects. He was a humane and indulgent sovereign, and maintained by his domestic and civil policy the tranquillity of the empire.

Othman III. was at the age of 53 called from his prison to a throne, and his demeanour and conduct throughout his short reign was a striking commentary upon the miserable education which the Ottoman princes enjoyed among the eunuchs and female attendants of the *eski serai.* His reign is chiefly remarkable for a terrible conflagration which happened in 1756, and which consumed nearly three parts of the capital, or about 80,000 dwellings. Having no sons of his own, Othman became jealous of the space which his nephews, the sons of Achmet, filled in the view and affections of his subjects, and he formed the unnatural design of destroying the whole royal race of the Ottomans. Two of these princes perished by poison. Mustapha tasted the deadly drug, but recovered, and he and Abdul-hamid escaped only by the death of their uncle.

Mustapha III. during the first ten years of his reign maintained inviolate the treaty of Belgrade; and while Catherine II. was developing her plans of spoliation and aggrandisement in the dismemberment of Poland, he confined himself to remonstrances against her outrages and usurpations. During this period he was assisted by his able and enlightened vizier, Mahomet Raghib, in restoring order and energy to his domestic government. The encroachments of Russia, however, upon his frontier at last compelled him to take up arms. The war was commenced by an irruption of Tartars under Krim Guary, who laid waste new Servia and carried the inhabitants into captivity; but this indefatigable chief by his superior skill and boldness had rendered himself an object of jealousy to the grand vizier Mahomet Emir, and, as he was preparing for an irruption into Poland, he was cut off by poison. In the following year the inexperienced Mahomet rashly advancing to the Polish frontier was defeated by Prince Galitzin, and paid for his rashness with the loss of his head. His successor Moldovandgi, though a general of bravery and reputation, was equally unfortunate. He attempted to pass the Dneister in the face of the Russian army, when his bridges were swept away by a sudden swelling of the river, which excited such a panic among his troops that they fled in confusion, leaving the strong fortress of Choczim an easy prey to Galitzin, who immediately advanced into Moldavia. These disasters induced Mustapha to think of peace, but the ambition of Catherine insisted upon the cession of Moldavia and Wallachia. The sultan, therefore, prepared for another campaign; but his army after two severe defeats was driven within the Danube, and the principal fortresses in Besserabia fell into the hands of the Russians. Bender was also taken by assault, and the greater part of the garrison put to the sword.

While the Turks were every where repulsed in the north, Catherine sent a Russian fleet with troops into the Morea to excite the Greeks to throw off the Turkish yoke. The Ottoman fleet, after a severe action, was defeated, and was afterwards burnt by the enemy in the bay of Tchesmé; but the Greeks were afterwards abandoned to their fate, and their attempt at emancipation served only to rivet their chains the more closely.

Repeated attempts were made at negotiation in 1771, and at the same time a desultory warfare was prosecuted on both sides, but without any decisive result. The Russians overran the Crimea, while the Turks took the fortress of Giurgevo, but were afterwards compelled to relinquish it. The campaigns of the two following years were in general advantageous to the Ottomans, the enemy having been repulsed with great loss from before Silistria and Varna, and driven across the Danube. During these transactions Mustapha was carried off by an attack of dropsy in the stomach. He was a prince of considerable endowments, and notwithstanding his scanty education, he was held in high estimation by his subjects as a wise and enlightened sovereign. He stood firm and undismayed amidst the reverses and dangers which surrounded his throne, and exhorted his successor to resist to the last the ambitious designs of the Russians.

Abdul-hamid made extraordinary efforts to maintain his position on the Danube; but though his forces were superior in numbers to the enemy, they shrunk from the contest, and Marshal Romanzow passed the river and proceeded to attack the Turkish camp at Schumla. By a masterly movement he cut off all communication between the vizier and his military stores, which produced such consternation in the Ottoman army that they abandoned their standards and fled in all directions, leaving, of all their host, only 12,000 men to defend the standard of the prophet. The vizier immediately sued for peace. The preliminaries were dictated by the Russian general, and were signed in the Russian camp at Katchouk Kainardghi. The interference of Austria preserved to the Porte the provinces of Moldavia, Wallachia, and Besserabia; and she had also restored to her the Grecian islands which had been captured during the war; the Crimea was declared independent of the Porte; Russia retained her conquests between the rivers Bogh and Cuban, and her merchant vessels were admitted to the navigation of the Bosphorus.

The nominal independence of the Crimea was but of short duration. The empress soon found means of exciting domestic troubles in that country, of which she made a pretext to unite it to her own empire. The weakness of Turkey compelled her to submit to this new aggression. A repetition of insults, however, from the ambitious Catherine, who with the emperor Joseph had formed the design of dividing between them the Ottoman dominions, as they had formerly done those of Poland, drove the Turks to take up arms, as their only hope of defeating this project.*

The Austrians also hurried into the contest, and assaulted Belgrade without the formality of a declaration of war. They were however repulsed on all sides; and the grand vizier entering the Bannat swept it of its inhabitants, and spread consternation and alarm to the very gates of Vienna. The Russians were more successful. The Ottoman fleet was destroyed in the mouth of the Dneiper, and the important fortress of Oczakow, after an obstinate and courageous defence, was taken by assault, when the whole of the garrison and most of the inhabitants were put to the sword. At this stage of the war, Abdul-Hamid was succeeded by his nephew SELIM III., who, instead of giving his attention to the depressed state of his affairs, commenced his reign by a course of thoughtless folly and dissolute extravagance. Several years after, however, when his natural talents were developed, he became one of the mildest and most humane sovereigns that ever sat upon the Ottoman throne.

The Austrian and Russian armies, under the prince of Cobourg and general Suwarroff had formed a junction in Moldavia, and having defeated a Turkish force commanded by Hassan-bey, advanced along the Siret to the plains of Rimnik. Here the Turks, led by the grand vizier, were routed with terrible slaughter, and with the loss of all their cannon and military stores. The Austrians then diverged into Wallachia, and took possession of Bucharest; while Suwarroff, having received the submission of Bender and other fortresses in Besserabia, laid siege to Ismail. This fortress was defended by 40,000 Turks; but Suwarroff was commanded to take it at any cost. Ten thousand Russians fell in the assault; but the laurels of the merciless victor were indelibly stained by the sack of the city, and the massacre of its brave garrison. Belgrade also capitulated to marshal Loudon, and the strong fortress of Nissa was the only barrier between his victorious army and the Ottoman capital. The enemy were thus advancing triumphantly on every side, and threatened the very existence of the Ottoman power in Europe. At this juncture the emperor Leopold succeeded to the Austrian sceptre; but instead of prosecuting the advantages which his troops had gained, he maintained merely a defensive position, and soon after, through the mediation of the courts of London and Berlin, entered into a treaty with the porte, by which Belgrade and all the Austrian conquests were restored, except the temporary retention of the city of Choczim. The Russians continued to prosecute another successful campaign, when Catherine also became desirous of peace, and the treaty of Jassy put a period to the war. Of all their conquests, the Russians retained only the fortress and territory of Oczakow, and demanded 12,000,000 of piastres as an indemnity for the expenses of the war. This sum, however, was afterwards generously renounced by the Russian empress.

The Ottoman empire escaped from this dangerous war with the loss of only a small portion of its territory, but its internal organization was shaken to the centre. The government was overawed and controlled by the rebellious janissaries, who regarded every improvement or reform with jealousy and aversion; and these troops, from being at one time the most efficient in the world, had been gradually retrograding till they had now become little better than a disorderly crowd, without discipline or energy, and so easily panic struck, that the duke of Saxe Cobourg used to say that "when one has only once well beaten the Turks, one is at ease for the whole campaign."

While the capital was exposed to military outrages and insurrections, the provinces had shaken off the authority of the sultan. Ali-bey had usurped in Egypt, the power and rank of an independent sovereign. Ali Pacha of Janina had resisted the authority, and defied the enmity of the porte. Paswan Oglou had raised the standard of rebellion at Widin. The Servians had taken up arms under Czerni George. Arabia was possessed by the Wahabites. The pachas of Asia Minor, ambitious of independence, and secure in the weakness of the government, set at defiance the firmans of the grand seignior. Selim and his ministers became alarmed at the general disaffection, and the reverses of the last war convinced them that the safety of the empire depended upon the extinction of the influence of the janissaries, and a thorough renovation of its military system. They therefore prepared for the gradual introduction of the more improved tactics of modern warfare; and as a prelude to a more general measure, a levy of 12,000 men were armed and disciplined after the European fashion. These troops were distinguished from the janissaries both by their uniforms and arms; and had splendid barracks erected for their accommodation at Leven Tchiftlik. Reforms were also introduced into all the other departments of the military and naval service, and a general regulation provided that the new discipline should be gradually communicated to the janissaries. In order to meet the increased expenditure of the state by these improvements, new and extraordinary taxes were imposed; and this revenue was placed under the control of a distinct officer of state, with the title of Treasurer of the New Bank. This military establishment was introduced under the name of *Nizam Djedit* or new constitution; and the improved discipline of the troops proceeded with considerable success, and without exciting much attention.

The steadiness and bravery of the new corps in the defence of St. John d'Acre made them be received on their return to Constantinople, with great affection and enthusiasm; and they farther acquired the confidence and gratitude of their countrymen, by extirpating the predatory bands which had long continued to infest the provinces of Bulgaria and Roumelia. These important services were followed by liberal honours and rewards; and sultan Selim, availing himself of the general feeling of enthusiasm in favour of those forces, resolved to increase their number, and issued an order for a levy of picked men from the janissaries to be incorporated with the nizam djedit. This measure was received by the haughty janissaries with the most marked antipathy and opposition. They could not but foresee, in the success of this project, the extinction of that overpowering influence which they had so long maintained in the government, and they consequently spread disaffection and discontent in the principal cities of the empire. After a series of difficulties and dangers, the order was suspended; but the flame which it had raised continued to increase in measure and intensity until it involved the unfortunate Selim and his ministers in its devouring vortex.

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* The great object of Catherine's ambition, and which during her long reign she never lost sight of, was the possession of the capital of the lower empire. In 1780 she caused a medal to be struck, on which was represented a flash of lightning striking the mosque of St. Sophia at Constantinople; and to her other titles was added *Propugnatrix fidei*. The emperor Joseph, when at St. Petersburg, said to the grand duke Paul, "The empress has great projects. She will leave Rome to me, and keep Constantinople for herself, in order to restore the old imperialities of the east and west. This would do very well were we alone the rulers of the world."—*Foreign Review*.

During these disturbances, the affairs of the empire were distracted by the contending influence of France and England. The councils of France at last prevailed, and precipitated a war with England and Russia. The latter power seized upon the principalities, while the English, under admiral Duckworth, passed the Dardanelles and approached the capital, but were compelled to make an inglorious retreat. Freed from any immediate apprehension of danger from that quarter, the divan directed an extraordinary levy of troops for the recovery of the principalities. But while the army under the grand vizier was hastening to the seat of war, an insurrection of the janissaries precipitated Selim from his throne. This revolt was hastened by the death of the mufti, who had been the early, faithful, and tried friend of Selim, and who had also assisted and supported him in all his plans of reform. His successor, on the contrary, entertained a personal dislike to his sovereign, and was besides inimical to the new institutions. The same sentiments were harboured by Musa Pacha the kaimaken, who with an outward show of devotion and attachment to Selim, was crafty, cruel, and ambitious, and waited only for an opportunity to overturn the existing government, and to rise upon its ruins. The absence of the vizier from the capital had placed the executive power in the hands of Musa, who was thus enabled to prosecute his machinations with the less risk of discovery. He accordingly fomented the discontents of the janissaries, and directed their hostility against the new institutions. An order for clothing a few Yamaks, who formed part of the garrisons in the batteries of the Bosphorus, with the new uniform, and incorporating them with the nizam djedits, was made the signal of revolt. These troops, issuing from their quarters, assembled at Buyukdere, and having chosen a leader, marched directly to the capital. Here, at the instigation of Musa, they were joined by the seditious janissaries, who repaired to the Atmeidan* with their kettles sounding, and demanded the heads of those ministers who had favoured the new institutions. Selim, who had hitherto been kept in ignorance of these proceedings, and misled by the treacherous kaimaken, was now aroused to a sense of his danger, and endeavoured to avert the fate of his friends by an offer to abolish the nizam djedit; but the demand was reiterated, and seven heads were on the morrow presented to the insurgents, with an order for the suppression of the new institutions. The traitor Musa, however, with his associate the mufti, encouraged the rebels to demand a nobler sacrifice, and a thousand tongues called for the deposition of Selim, and the elevation of Mustapha, the son of Abdul-Hamid.

The revolution which raised MUSTAPHA IV. to the throne, threw the whole executive power into the hands of the kaimaken and the mufti, and the sultan became the passive instrument of those to whom he was indebted for his sceptre. The associated traitors, however, could not long agree; and in the struggle for pre-eminence Musa was banished, but the triumph of the mufti was but of short duration. The violence and insolence of the janissaries excited universal complaints, and a counter-revolution was speedily effected by the daring energy of the pacha of Rudshuk. This chief retained the surname of *Bairactar* or standard bearer, intimating the humble rank from which he had been raised, and had always regarded Selim as his patron and friend. Collecting a band of 40,000 Albanians, he hastened to the capital, and sent an intimation to the sultan, that he came to reform the abuses of the state. Mustapha, alarmed for his personal safety, readily submitted to the first demands of Bairactar, and consigned to punishment the mufti and the seditious Yamaks. But the pacha of Rudshuk had a higher object, and contemplated nothing less than the restoration of his former master. His determination, however, had been allowed to transpire; and when he marched to the seraglio he found the gates shut, and preparation made for resistance. The disappointed chief ordered an immediate assault, and soon forced his way into the palace; but this short delay was fatal to the deposed sultan, and when the impatient Bairactar called for the appearance of Selim, the body of his murdered friend was cast down before him. Overwhelmed with grief at the sight, he kept kneeling beside the corpse until he was reminded that the time for revenge was now come. Proceeding to the presence chamber, he pulled the sultan Mustapha from his throne, and the cannon soon after announced to the people the elevation of MAHMOUD II.

Mahmoud had escaped the fate of Selim, only by the fond fidelity of a slave, who had concealed him in the furnace of a bath; and though diligent search was made for the royal victim, the forces of Bairactar had burst into the seraglio before the executioners had discovered the place of his concealment. The services of Bairactar were rewarded with the office of grand vizier, and the first acts of his government were directed against the promoters of the late revolt. Thirty-three heads, among which was that of the traitor Musa, were exhibited at the seraglio gate; the officers of the Yamaks and the most seditious of the janissaries were seized, strangled, and cast into the Bosphorus; and the females of the harem who had rejoiced at the death of Selim were sewed up in sacks, and thrown into the sea from the tower of Leander. Having exacted this terrible retribution, the avenger of Selim proceeded to carry into effect those projects of military reform which had cost his lamented master his throne and his life. Instead, however, of re-establishing the nizam djedit, he proposed to revive the military order of the Siemens,—a name more hateful to the janissaries, because more ancient than their own, than the despised nizam djedit. The first steps in this measure were conducted with great prudence and success, and the janissaries were overawed by the presence of the Albanian troops. Trusting, however, to his own power and influence, he despised the enemy whom he had humbled, and who felt the injury too deeply ever to be reconciled to their degradation. Their apparent submission deceived the too confident Bairactar, and mistaking their silence for acquiescence in his measures, he despatched the greater number of his Albanians to the provinces. He thus left himself to the mercy of a body of men who had long been accustomed to dictate to the sovereign, and who would never forgive the wrongs inflicted upon them by a subject.

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* The Atmeidan is an open square on the south side of the city, not far from the porte, where the soldiers received their rations, and from time immemorial had been chosen as the rallying place of the insurgent janissaries.

The feast of Bairam, which is devoted by the Turks to public rejoicings, was chosen by the janissaries for a general rising; and the grand vizier had scarcely returned from his accustomed visit of ceremony to the mufti, when his palace was surrounded by the insurgents, and immediately inveloped in flames. Bairactar, seeing all means of escape cut off, retired into a small square tower, which was used as a powder magazine, and which he hoped would resist the flames and the attacks of his enemies. But here the unfortunate vizier met his fate, for during the night a tremendous explosion intimated to the whole city that the magazine with its inmates had been blown into the air. The two following days were passed in a sanguinary struggle between the siemens and janissaries. The former were supported by 8000 Asiatics, under Codi Pacha, the friend of Bairactar, and would have overpowered the insurgents; but the troops of the arsenal at Tophana having declared their adherence to the cause of the janissaries, decided the contest. Sultan Mahmoud, who had shut himself up in the seraglio, and had secured himself from the risk of deposition by the death of Mustapha, despatched a message to the victors, with the assurance that the cause of their complaints was removed, and that the order of siemens no longer existed. Tranquillity was speedily restored, but this bloody tragedy cost the empire many valuable lives; and about a third of the city, with the finest part of the seraglio, was destroyed in the conflagration.

While these scenes were passing in the capital, hostilities with Russia had been arrested by the treaty of Tilsit, in which the Ottomans had been taken under the protection of France. But when Napoleon directed his views of spoliation to Spain, he endeavoured to secure the forbearance of the emperor Alexander, by leaving Turkey at his mercy. The Russians consequently commenced their operations by a successful attack upon the Turks near Giurgevo; and, having opened a communication with the insurgent Servians under Czerni George, they crossed the Danube at Galatz. Several of the fortified towns on the right bank of the river yielded at their approach. Ismail surrendered after a short siege, and Silistria was summoned; but here they were furiously attacked by the Turks, and after two days' hard fighting, were compelled to recross the Danube.

In the campaign of 1810, the Russians were more successful. Having with difficulty passed the Danube, they advanced towards Bazardjik, which, after an able defence, fell into their hands. Silistria also capitulated; but failing in their attempt upon Varna, they invested the Turkish camp at Schumla. Negotiations for an armistice were opened by the grand vizier; but the conditions were so exorbitant on the part of the Russians, as left no alternative but a brave defence, when the Russians were obliged to raise the siege, and retire back to the Danube. The campaign was closed by the capitulation of Rudshuk. In the following year, the Russians under Kutusoff attacked the Turkish entrenchments at Cadi Keuï; and though successful, they retired at midnight upon Rudshuk, which having burned to the ground, they departed beyond the Danube. The Ottomans now assumed the offensive, and by a masterly movement, the vizier crossed the river with 6000 men and six pieces of cannon, and took up a position on its left bank, about two leagues above Giurgevo. Here the Turks bravely defended themselves for four weeks, when, through the remissness of their commander, the Russians having taken possession of their camp, they were routed, but afterwards concentrated themselves at Rudshuk, which they maintained until they were relieved by the peace of Bucharest. By this treaty, Russia obtained the whole of Besserabia, with that part of Moldavia which lies on the left bank of the Pruth, and the fortresses of Choczim, Bender, Ismail, and Kilia. An amnesty also was granted to the Servians.

Mahmoud being now relieved from foreign danger, began to display those qualities of courage, energy, and political wisdom which have stamped him as one of the ablest potentates of his time. Drawn from a prison, and raised to a throne when a youth of only fifteen years of age, he was early involved in a contest with the janissaries, in which he would undoubtedly have been sacrificed, had there been a survivor of the imperial house old enough to sit upon the throne. The total dissolution of social order in the provinces demanded his immediate attention; he therefore resolutely prepared to reduce his refractory vassals to obedience, and in a few years, by vigorous and decisive measures, restored order and tranquillity to the greater part of his distracted empire. He abolished the hereditary pachaliks, deposed or put to death the rebellious pachas and agas, and entirely suppressed the insolent janissaries, who, under the direction and influence of the ulema, had so long held the sovereign and capital in thraldom.

In Arabia, the Wahabites had occupied the sacred territory of Mecca and Medina. Their chief, Sahoud Abdallah, ruled over the province of Nedjed and the isles of Bahrein, and held as tributaries the Imaums of Sunna and Muscat. The annual pilgrimages had thus been interrupted for many years, and the faithful Mussulmans had been interdicted from paying their vows at the shrine of the prophet. The reduction of this sect was intrusted to Mahomet Ali, the viceroy of Egypt, who despatched a messenger to acquaint Abdallah that he would invade his dominions, raze his capital to the ground, and lead him captive to Constantinople. Ibrahim Pacha, the son of the viceroy, led the forces of Egypt, and after two years of dangerous warfare in Arabia, accomplished the threat of his father. Abdallah was brought a prisoner to Egypt, and then transported to Constantinople, with a solicitation from the viceroy for his pardon. But the fanaticism of the people demanded the blood of the unhappy chief, who had polluted with his sacrilegious hands the birth-place and tomb of the prophet.

The sultan had a more difficult task in reducing the refractory pacha of Janina. This Albanian chief had risen from a very humble origin; but no sooner was he invested with the pachalik of Janina than he assumed the rank and power of an independent sovereign. By open hostilities, or by secret assassination and treachery, he had extended his sway over the whole of continental Greece and Epirus. His infantry were the best in the empire; and had he possessed the affections of his subjects, he might have bid defiance to the power of the porte. But his atrocities and oppression had rendered him odious to the Greeks; and his promises and kindness, in his hour of need, were disregarded by those who had so long suffered from his tyranny. For two years he resisted the armies of the sultan; and when driven to his last strong-hold, the castle on the lake of Janina, he made a desperate struggle to recover his affairs. His destruction was at last accomplished through the treachery of one of his officers, who admitted the Turks into the castle, when the old pacha retired into an insulated tower with his wives and treasures, and about a hundred followers. Here, with a magazine of powder under his feet, he formed and announced the terrible resolution, that on the approach of an enemy he would blow the whole into the air. He was however induced, by fair promises and pledges of safety, to surrender; and thus fell into the same snare which he had often practised upon others, his death being immediately decreed by a firman of the sultan.*

The reduction of Ali Pacha was retarded, and almost entirely interrupted, by an insurrection of a more formidable character, and which has wrested from the empire one of its finest provinces. The Greeks had long borne the cruelties and thraldom of the rebellious Ali; but now throughout the continent and islands of their classic land, roused themselves as a united people, to break the shameful yoke under which they had groaned, and to retaliate upon their oppressors the wrongs and extortions of two hundred years. The first war-note of liberty was raised in the streets of Jassy, the capital of Moldavia. Alexander Ipsilanti, a major-general in the Russian service, in concert with Michael Suzzo, the hospodar of that province, seized upon Jassy, and at the head of 15,000 men, entered Wallachia. Confiding in the countenance and support which they expected to receive from Russia, they hastened to Bucharest; but they were arrested by an order from the emperor Alexander, who, alarmed by the very idea of a popular insurrection, declared his decided hostility to their cause. Upon this, Michael Suzzo retired from the contest; but Ipsilanti continued his route, and uniting his forces with a band of Wallachians, took possession of Bucharest, which he prepared to defend against the coming forces of the Turks. The Wallachian confederates, however, betrayed him in the hour of trial; and at the battle of Dragaschan his little band, surrounded by the superior numbers of the enemy, was nearly cut to pieces. Retreating to Rimnick, he disbanded his followers, and hastened to join his fellow patriots in Greece; but arriving at Trieste, he was seized by the Austrian authorities, and cast into prison.

While in Wallachia, the voice of liberty was stifled in its birth, it sounded a louder note along the shores and islands of the Ægean sea, and was reechoed from Sparta to Macedonia. The Morea, however, was the principal theatre of action, and a general congress was formed at Calamata for the purposes of union and subordination. The small islands of Hydra, Spezzia, and Ispara were also forward in the cause, and supplied a marine of more than a hundred armed vessels, manned by the best and bravest seamen in the empire.

The news of the Greek insurrection fell like a thunderbolt upon the populace of Constantinople, and they could not at first believe that the slaves of Greece would so boldly court destruction from the strong arm of their Ottoman masters. When convinced, however, of the reality, their astonishment was turned into fury, which they proceeded to gratify by a general massacre of the Greek population of the Fanar, accompanied with circumstances of aggravated cruelty and insult. The venerable patriarch of Constantinople, with four of his archbishops, were on Easter Sunday hanged before the doors of their respective churches; and their bodies, after remaining supended for three days, were delivered to the Jews, who treated them with every species of ignominy, and then threw them into the canal. Similar scenes were acted at Adrianople and many other parts of the empire. But these atrocities served only to fire the Greeks with more deadly enmity against their tyrants; and it is to be lamented that they were led to imitate those savage acts of outrage and cruelty at which humanity recoils.

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* "The traveller, in proceeding from Constantinople by the gate of Selyvria, sees on a parapet wall raised on the wayside five Turkish tombstones, ranged in a line in a remarkable manner, and forming striking objects in a small cemetery; these are the monuments of Ali Pacha, his three sons, and his grandson. The inscriptions import, that 'here is deposited the head of the once celebrated Ali of Tepeleni, governor of the Sanjak of Janina, who, for upwards of fifty years, pretended to independency in Albania.' Similar, in some degree, is the record of Mouktar Pacha, of Veli Pacha, of Saelih Pacha, and of Mehemed Pacha; their five heads were purchased of the public executioner for a great price, and interred by the man who had long transacted the duties of his confidential agency at the capital."—*Upham.*

The first great effort of the Peloponnesians, under Mauro Michale and Colocotroni, was directed against Tripolitza, the capital of the province; which, after a terrible resistance, was taken by assault, when 8000 of the inhabitants are reported to have perished in the sack of the city. Very considerable treasures and military stores fell into the hands of the victors, and furnished a seasonable supply to the half armed peasantry which composed their armies. This was followed by the capture of Corinth, to which city the general congress was removed; and, soon after, the plan of a general constitution was matured and promulgated amid the acclamations of the deputies and people. By this constitution, the legislative power was vested in a senate chosen by annual election from the different districts of Greece; and the executive government was lodged in a council of five, to whom were committed the disposal of the forces by sea and land, and who had also a negative upon all laws passed by the senate. Their naval successes were equally brilliant. Their flotilla captured a Turkish seventy-four in the Gulf of Adramytti, which so alarmed the rest of the fleet, that the Turkish admiral fled for shelter under the cannon of the Dardanelles.

The successes of the Greeks determined the Porte to pour such a force into the Morea as would defy all opposition, and crush at once this dreaded insurrection. Chourschid Pacha assembled 50,000 troops in the plains of Thessaly; and a fleet was equipped to co-operate with this army, and to land additional forces in the Gulf of Lepanto. This fleet, however, was ordered to commence the campaign by a descent upon Scio, which, by the assistance of the Samians, had just thrown off the Turkish yoke, and declared its independence. A horde of Asiatic barbarians was transported from the opposite coast, whose numbers and fury soon overpowered the unwarlike Sciotes, and left the whole island at their mercy. The splendid city and flourishing villages of this beautiful island were sacked and burned, and their population butchered without regard to age or sex. Of its 100,000 inhabitants, not a fifth part remained to occupy its smoking ruins. Fifteen thousand are supposed to have escaped to the neighbouring islands; 25,000 perished in the massacre; and 41,000 were sold into slavery. While this terrible tragedy, which filled Europe with horror and indignation, was perpetrating at Scio, Chourschid Pacha passed the straits of Thermopylæ without resistance. Corinth and Argos surrendered at his approach, and the Greeks were compelled to retire from before Napoli de Romania, which they had long blockaded and had reduced to the last extremity. Chourschid, however, had advanced without magazines and supplies; and when he endeavoured to retrace his steps, the Greeks, who being unable to cope with their invaders in the plains, had seized all the passes and defiles, by a succession of encounters so harassed and obstructed his retreat that he reached Corinth with the loss of nearly 25,000 men. The fall of Napoli de Romania was the consequence of this disastrous retreat. In western Greece, the Turks under Omer Vrione succeeded in taking the capital of the Suliotes; but failed in their attack upon Missolonghi. The following campaign was equally discreditable to the Ottoman arms; and the recovery of Corinth by the Greeks shut them out from the Morea.

The Greeks were no sooner relieved for a time from foreign danger, than a struggle ensued for the government of the commonwealth. Colocotroni and other military chiefs assumed an authority inconsistent with the free deliberations of the congress. This led to a civil war, in which the congress prevailed, and the refractory chiefs were deprived of their commands.

The Porte, finding all his endeavours to recover his supremacy in Greece ineffectual, induced the Pacha of Egypt, by the offer of large bribes, and the government of the conquered country, to make common cause with him against the insurgents. But before the arrival of his new ally, a large armament under the Capitan Pacha was directed against Ipsara, the great naval bulwark of the Greeks. This island was so strongly fortified, that it was considered impregnable. Several hundred pieces of cannon were planted around the coast, under whose cover numerous gun-boats lay ready for attack. But the Turks, by exciting a false alarm for the safety of the town, landed almost without resistance on the opposite side of the island; and, notwithstanding the desperate valour of its brave defenders, Ipsara soon became the prey of the barbarous victors. The tragic scenes of Scio were reacted at Ipsara, which was reduced to a desert, without house or inhabitant. With the exception, however, of this capture, the Ottoman forces, even when joined by their Egyptian allies, made no impression upon any other point during the campaign. Their troops were reduced to a defensive position, and their fleets were forced into the Dardanelles.

The successes of the Greeks had only engendered jealousies and dissensions in their councils. Their military arrangements were consequently conducted with apathy and indifference. But they were terrified into more vigorous measures by the formidable armament of Ibrahim Pacha, which was directed against Navarin. The presidency of the executive council was conferred upon Conduriotis, who was invested with dictatorial powers; and his first step was to strengthen the garrison of Navarin, which he augmented to 2000 men besides a corps of artillery. He also assembled a force of 3000 men with which he attempted to dispute the approach of Ibrahim; but this army was defeated and dispersed by the Egyptian troops, and Navarin, after a month's siege, was compelled to capitulate. The Egyptians proceeded without opposition to Tripolitza, which they entered on the 20th of June, and the fortress of Arcadia, though gallantly defended, was finally overpowered, and its small garrison put to the sword. Ibrahim then attempted the capture of Napoli, the seat of the Greek government, but was repulsed with great loss, and retired to the coast of Argos, where he received reinforcements from Salona. The Greeks, under Colocotroni, who had been again placed at the head of their armies, suffered another severe defeat in the neighbourhood of Tripolitza; and Ibrahim having ravaged the whole country, was left master of the plains and most of the fortresses of the Morea.

In western Greece, Missolonghi was besieged by the Seraskier Redschid Pacha, who, having spent the greater part of the summer without making any impression upon the fortress, now prepared for a general assault. After a sanguinary conflict the Turks forced their way into the city, but were finally repulsed; and the Greeks afterwards retaliated upon the besiegers by repeated and successful sorties. In a subsequent assault, the Seraskier was equally unfortunate, and was at last compelled to abandon his camp. Peremptory orders, however, were dispatched to Redschid to renew the siege; but, though reinforced by a body of disciplined Egyptians, he failed in every attempt, and retired during the rains to the heights of Mount Aracynthus. The reverses of the Seraskier determined the Porte to confide the siege of this important fortress to Ibrahim Pacha with an army of 25,000 men. Missolonghi was the principal strong-hold of the Greeks in Livadia, and as its fate involved that of Greece, every exertion was made by the government for its defence. Its garrison consisted of 5000 warriors, and its original population of 3000 had been raised to 13,000 by the arrival of refugees, who confided in its natural and artificial strength. This siege is memorable for the bravery and resolution of its defenders, the sufferings of the inhabitants, and the romantic courage with which a part of its garrison cut their way through the enemy's entrenchments. As early as February the want of provisions and powder was severely felt by the garrison; and the Grecian fleet was not expected with supplies until the beginning of April. Ibrahim prosecuted the siege with great determination; and after many a fierce contest, had succeeded in cutting off the besieged from all their external communications, and reducing them to the last extremity of famine. For many weeks they were confined to quarter rations, and were at last under the necessity of devouring horses, dogs and mice, and crabs and sea-weed which they collected under the very fire of the enemy. While in this miserable condition their hopes were revived and their spirits gladdened by the appearance of the Grecian fleet under Miaoulis; but their joy was short-lived, for after repeated attempts, Miaoulis failed in breaking through the enemy's line and conveying to them the wished-for succours. Despairing now of all relief except in their own valour, they formed the desperate resolution of opening a passage through the ranks of the besieging army. On the 22d of April, about eight o'clock in the evening, a band of warriors, composed chiefly of Suliotes, made a sortie from the eastern gate of the city, and soon after a body of the inhabitants with their wives and children issued by a route nearer the sea, and less exposed to the fire of the enemy. This last column, being smartly attacked, were driven back, and Turks, Egyptians, and Greeks rushed into the city together. A dreadful conflict then ensued. Every house and street was defended with the rage of despair, and the enemy spared neither age nor sex. Many of the females threw themselves and children into wells and into the sea, or sought death by rushing upon the Egyptian bayonets. An end was at last put to this scene of carnage by the blowing up of the powder magazine and the bastion of Botzaris, which had both been mined, and which involved 2000 of the enemy in their ruins. While these scenes were passing in Missolonghi, the brave Suliotes, though assailed by a fire from the enemy's forts, advanced boldly to the Egyptian entrenchments, which they crossed in spite of all opposition; but before they reached Salona they had suffered so severely that they presented but a miserable remnant, oppressed with famine, wounds, and disease.

The downfall of Missolonghi was most disastrous to the cause of the Greeks; and it could scarcely be expected that they would recover from such a blow by their own unaided exertions. They still, however, disputed every post with an obstinacy and perseverance, which so roused the fierce indignation of the Egyptian pacha, that he covered the country with terror and desolation, cutting down the olive trees, destroying the harvests, and sweeping the female inhabitants into slavery. Greece, however, was saved by the interference of Great Britain, France, and Russia; and by the treaty of London the Morea and the islands were placed under their special protection. The faithless conduct of Ibrahim brought on the destruction of the Egyptian and Turkish fleets in the bay of Navarin; and the expedition of the French government into the Morea put an end in that country to the exterminating cruelties of the Egyptians. The armies of the sultan have been expelled from the soil of Greece, and her independence is guaranteed by the powers of Europe.

While the Greeks were thus struggling to be free, a contest of a most sanguinary nature was maintained at Constantinople, between the sultan and his rebellious janissaries. Halet Effendi, an enlightened minister, and the favourite of the sultan, had fallen a sacrifice to the jealous interference of these troops; and the frequent murders and frightful disorders which they committed rendered them so dangerous to the peace and happiness of the capital, that Mahmoud threatened to abandon Constantinople unless a stop was put to such atrocious proceedings. This threat produced a temporary quiet; but their rebellious movements were again renewed, and several of their officers, suspected of plotting against the life of the sultan, were arrested and put to death. Their outrages and domination, however, became at last so intolerable, that Mahmoud prepared to reduce them to subordination by forcing upon them a new system of discipline; and although every attempt to promote this measure had hitherto proved abortive and fatal to its supporters, yet he retained so strong an impression of its importance, that he resolved upon their submission or extirpation. At a general council of the principal ministers and officers of the Porte, it was determined to commence this measure by a draught of 150 men from each orta of the janissaries, who were to be drilled by Egyptian officers, and to be incorporated with the new troops. As these detachments entered upon the new evolutions, under an impression that they were merely the revival of an old exercise used in the time of Soliman, no dissatisfaction was evinced for some time, and preparations were making for a general review, when a standard-bearer happened to call out, "This is very like Russian manœuvring." The effect was instantaneous. These haughty troops no sooner perceived that they had been led to practice the hated exercise of the Nizam djedit, than their resentment was excited to the utmost. They immediately marched to the palace of the Porte, which having pillaged, they dispersed themselves throughout the city and committed the most frightful excesses. The grand vizier and Janissary Aga escaped their fury only by a timely flight to the country palace of Bashiktash, where the sultan was then residing.

Mahmoud was no sooner informed of the revolt than he hastened to the seraglio, and, with a prompt and energetic decision, took immediate steps for crushing with a strong arm those dangerous and turbulent subjects. At a meeting of the Divan it was resolved to display the *Sandschak Sherif;* and orders were dispatched to Hussein Pacha and the Topgee Bashi, or commander of artillery, to advance with their forces to the capital. The zealous Ottomans hastened to rally round the sacred banner, which was borne to sultan Achmet's mosque; and there, surrounded by the ulema and his court, the sultan pronounced an anathema against all who refused to acknowledge the symbol of the prophet. The janissaries, to the number of upwards of 20,000, had, as usual on such occasions, assembled in the Atmeidan; and the offer of pardon, upon condition of their submission, was received with scorn, and answered with the murder of the messengers, and a demand of the heads of the grand vizier, and other distinguished officers. The mufti having declared them beyond the pale of the law, and issued his *fetva* to that effect, Hussein Pacha was ordered immediately to advance and extirpate the rebels. Presuming upon their former power and privileges, and on the influence which they had hitherto exercised in the government, the janissaries awaited with confidence a compliance with their demands, when they were awakened to the dreadful reality of their situation by a discharge of grape shot among their dense and crowded masses. After a feeble resistance they retired to their barracks, and offered submission; but Mahmoud, convinced that the safety of the throne and empire depended upon their utter extinction, was inexorable. He ordered the barracks to be fired and no quarter given. The buildings were battered to pieces by cannon, and the wretched inmates who attempted to escape were thrown back into the smoking ruins. Above 4000 miserable victims perished by the shot or in the flames. During the two following days a tribunal sat in the Atmeidan for the trial of the insurgents. Every janissary taken in arms, or who was suspected of having been concerned in the revolt, was strangled on the spot; and others less culpable were banished to Asia. The numbers that suffered on this occasion could never be distinctly ascertained, but 20,000 at least were removed by death or exile.

A firman of the Porte abolished forever the name and institution of the janissaries; and thus was successfully achieved this great military revolution; and those turbulent troops, who, for upwards of four centuries, had exercised a control in the government alike incompatible with the dignity of the sovereign and the safety of the state, who had deposed and put to death so many sultans, and who had so often filled the empire with troubles and commotions, were swept from the capital, and crushed under the vigorous hand of the inexorable Mahmoud.

It was not to be expected that these severities would be passed over by a fanatical and prejudiced populace without animadversion and complaint; but the sultan was resolute in stifling every murmur. Four of the most distinguished of the ulema were accused of speaking irreverently of the sultan's projects, and exiled to Asia; and a Jew banker, who had been contractor for the janissaries, was put to death, and his property, amounting to nearly 69,000,000 piastres, was confiscated.

While Mahmoud was prosecuting his measures of reform, and securing tranquillity to his empire, one of those dreadful conflagrations, to which the capital of Turkey has been often subject, and was supposed to be the work of the disaffected, broke out on the 31st of August, and owing to a previous long drought and a high wind which prevailed at the time, destroyed about 6000 houses in the most wealthy and magnificent part of the city. Thousands of the unfortunate sufferers upon this occasion were received into the seraglio; and liberally supplied with provisions and shelter. The total loss was estimated at 300,000,000 piastres; and the sultan generously directed that a considerable portion of the expense of rebuilding the burnt part of the city should be defrayed out of his own treasury.

The threatening attitude of Russia compelled Mahmoud to persevere with unabated activity in the new organization and discipline of his army;

but as delay was, at this crisis, of the greatest consequence to Turkey, which Russia was anxious to prevent, Mahmoud submitted to the treaty of Akerman, which was concluded on the 7th of October. The principal article of this treaty respected the provinces of Moldavia and Wallachia, by which it was "determined that their boyars were to have the right of electing from their number their own hospodars, who were each to continue in office seven years; but that the sultan should have a *veto* in the election of a hospodar, on showing reasons satisfactory to Russia; and that the territories which had been detached from the two provinces should be restored to them." This treaty, however, though ratified by both governments, was in all its parts so favourable to Russia, that it was evident the Porte could have been reconciled to it only by the annihilation of the veteran force of his empire. In the *Hatti Sherif* of 20th Dec. 1827, addressed to all the pachas and governors of the empire, and to the ayans assembled at Constantinople, and which was intended to be kept secret, Mahmoud unreservedly declared that, in his negotiations with the allied powers, he adopted a tone of moderation, merely with the view of gaining time to carry on his preparations for war.

Russia could not well overlook this hostile declaration, and in her manifesto of 26th April, 1828, she conjoined with it other acts of oppression and breaches of faith, namely, the violation of her flag and the closing of the Bosphorus, as compelling her to have recourse to arms in defence of her honour and her just rights.

Mahmoud, seeing that a rupture could no longer be avoided but by a submission incompatible with the dignity and safety of his crown, prepared for the struggle. With his best troops occupied in Greece and Servia; his navy destroyed, and the janissaries annihilated, his principal dependence rested upon the raw levies of Asia, who could not be expected to cope in the field with the veteran forces of Russia, he therefore resolved upon strictly defensive operations—to strengthen his fortresses on the Danube, to concentrate his army at Schumla, and to defend the barriers of the Balkan.

The Russian army under Count Wittgenstein passed the Pruth in the beginning of May, and occupied the principalities without opposition. On their approach to the Danube, the Turks evacuated Galatz, after having converted it into a heap of ruins, and retired to Brailow. This place was defended with great obstinacy. One of its suburbs was taken by storm on the 15th of May; but so little impression had been made upon the fortress, that the Grand Duke Michael was left to prosecute the siege, while the emperor Nicholas with the army proceeded to the south and crossed the Danube on the 7th of June. The passage of the river was warmly contested; but the Turks, who had taken up a position of considerable strength with the fortress of Isakza on their left, were driven from their batteries and subsequently abandoned Isakza. The emperor proceeded without interruption, and without a gun almost being fired to molest his march. His advance was rapid and secure. The Turkish inhabitants retired before him; and the fortresses on his right and left yielded at his approach. His progress resembled more a holiday procession than the advance of a hostile army, till his career was stopped by the strong fortresses of Schumla and Varna. Having organized the siege of Schumla, which he left in charge of the commander-in-chief, and also that of Varna which he entrusted to Prince Menschikoff, the emperor set out by sea for Odessa "to wait until the arrival of reinforcements should enable him to undertake some enterprise worthy to be distinguished by his presence at the army."

The Porte now began to put forth all his strength in the defence of these important fortresses. Schumla stands in the very gorge of the Balkans; and is inclosed by a range of heights in the form of a semicircle, on which was formed the intrenched camp of the Ottomans. These heights being very steep, are impracticable on all sides except on the east, where the city is defended by redoubts, and by a wall which surrounds the intrenched camp. In this Thermopylæ of Turkey her principal army was concentrated, and entrusted to the command of the Seraskier Hussein Pacha, one of the ablest generals in the empire. Varna was also strongly reinforced by the arrival of the Capitan Pacha, who took the command of the garrison.

In the meantime Brailow had capitulated after a desperate resistance. Two days before its surrender, an attempt was made to carry the place by storm, which totally failed, the Russians having been driven from every point with the loss of nearly 2000 killed and wounded. So hostile, however, were the inhabitants of Brailow to the authority of the czar, that they all, amounting to 13,500 souls, quitted the city with the garrison.

The Russian advanced guard, under General Rudiger, pushed forward to Eski Stamboul, for the purpose of cutting off the communication of Schumla with the capital, by occupying the roads to the Balkan, and thus preventing supplies from reaching the besieged. After several severe conflicts the Russians maintained their position at Eski Stamboul, and also accomplished the construction of three redoubts. On the 25th of August, however, the Turks made a desperate sortie upon these redoubts, attacking at the same time both wings of the Russian army, and also the camp at Eski Stamboul. The night was dark and tempestuous, and the Russians were under no apprehension of such a visit. The first redoubt was carried by surprise, and its garrison with general Wrede put to the sword. The two other redoubts were destroyed and several cannon carried off. Both sides in their bulletins claimed the victory; but though the Turks were latterly repulsed, the Russians were compelled to retreat from their advanced position, and concentrate their forces before Schumla. By these vigorous attacks, however, the Turks succeeded in conveying supplies both of men and provisions into the besieged fortresses. Hussein Bey, on the morning of the 9th of September, again attacked in great force the right and centre of the Russian line. "Thrice (says the Russian bulletin) did the Turks approach the two Russian redoubts, and thrice did they throw themselves into the trenches;" but they were repulsed with considerable loss. The Russians soon after withdrew their head-quarters to Jenibazar, on account of a scarcity of forage, where they stopped only one day and prepared to retreat towards Bazardjik. Hussein immediately quitted his entrenchments at Schumla with 70,000 men in pursuit of the enemy; and with the intention also of raising the siege of Varna. Varna, however, had fallen, and Hussein confined his operations to harassing the Russian army in its retreat to the Danube.*

The operations before Varna were repeatedly interrupted by sorties from the garrison, who seem to have neglected no opportunity of impeding the enemy's advance. Admiral Greig had also blockaded the fortress by sea, and had captured fourteen Turkish vessels, which were stationed under the batteries. The emperor returned to Varna early in September; and the Russian operations being completed, the garrison was summoned to surrender. The flag of truce sent into the fortress was followed by a temporary suspension of hostilities. The Capitan Pacha had an interview with admiral Greig on board his flagship; but, as the Turks appeared to be merely desirous of gaining time, the negotiations were broken off. This conference, however, was fatal to Varna, as it afforded an opportunity to the Russians to tamper with the fidelity of Yusuff Pacha, the second in command. The fortress was surrendered on the 11th of October, it was said at discretion, owing to a sudden panic in the garrison. It is, however, alleged that Yusuff Pacha, on the appearance of a small party of Russians, who had pushed forward into the place, ordered his troops to lay down their arms without having obtained the concurrence of the Capitan Pacha. This chief retreated into the citadel; but was next day allowed to retire with 300 of his followers. Omer Vrione who commanded the Turks in the neighbourhood of Varna, immediately retreated beyond the Kamtchik, where he was afterwards joined by the grand vizier, who had left the capital with 10,000 troops on the 20th of August, but who did not arrive at Schumla until the Russians were preparing to retreat.†

In Little Wallachia the Turks, under the Pacha of Widin, suffered a severe defeat on the 26th of September. Advancing with 18,000 men against the positions of General Geismar, they were so warmly received, that the action continued during the day without any decisive result, and both parties retired. At nightfall, however, the Russian general surprised the Turkish camp, and his impetuous attack was followed by a complete rout until the Turks reached their entrenchments at Kalafat. From this position they were also driven across the Danube; and the Russians fortified and garrisoned the place to prevent further incursions into Little Wallachia.

During the siege of Silistria, which was invested by General Roth on the 31st of July, the Russians endured great sufferings and privations; and were at last compelled to raise it with the loss of all their cattle, and the abandonment of the greater part of their artillery.

The severity of the weather put an end to hostile operations on both sides. Part of the Russian army retired to winter in Moldavia and Wallachia; the rest were posted in the fortresses of Bulgaria, and preserved their communication between Varna and the Danube. The Turks, after an unsuccessful attempt upon Varna and Bazardjik, established their head-quarters at Aidos.

In Asia the Russians were more successful throughout the campaign. Anapa surrendered to Admiral Greig early in summer; and Count Paskevitsch reduced Kars, Akhallalaki, Akhallsykh, Bajazet, Atskhour, and Ardagan.‡

The unexpected fall of Varna greatly exasperated the sultan against the grand vizier, who was accused of not having acted with sufficient energy in relieving the fortress. He was consequently deposed and banished; and the Capitan Pacha, the brave defender of Varna, received the insignia of the empire. The traitor Jusuff Pacha was publicly outlawed, and his property confiscated.§

Russia had little to boast of in the issue of this campaign. After all her mighty preparations, her troops were stopped by the Balkans, the first spot where they met with a Turkish army. Her only conquests of importance where any resistance to her arms was offered were Brailow and Varna, and this last was obtained by treachery; and she acknowledged the loss of 20,000 men slain, or so badly wounded as to be incapable of again serving. The capture of Varna, however, and more especially the destruction of the Turkish fleet at Navarin, which the Russians could not have accomplished in open and honourable warfare, gave them a decided advantage in the following campaign. By the former she obtained a point of advance, which gave her the command of the road into the plains of Roumelia; and by the latter she obtained the command of the Black sea, which enabled her to harass the Turkish coasts, and to convey reinforcements and supplies to her invading armies.

* The retreat of the Russians, according to some accounts, was most disastrous. "The roads were covered with the carcasses of many thousand horses, and almost impassable; while the soldiers, famished and in tatters, covered with filth and vermin, could with difficulty pursue their march, and frequently sunk under their manifold fatigues."

† The grand vizier's march from Constantinople was delayed for several days by the discovery of a conspiracy against the life of the sultan by the partisans of the old janissaries, which, however, was immediately crushed by the vigorous measures of Mahmoud.

‡ The fruits of the whole campaign are thus enumerated by the Russians: "In Europe, Moldavia, Great and Little Wallachia, and a considerable portion of Bulgaria have been conquered; eight fortresses have been taken independently of the fortified positions on the Danube; and two of the enemy's camps have been captured. Our trophies consist of 957 pieces of artillery, 180 standards, and incalculable quantities of stores. Seventeen large and 45 small vessels have been partly sunk and partly taken. Nine pachas, and 22,500 men have laid down their arms, and thousands of Bulgarians have been rescued from servitude. In Asia, three pachaliks or governments, six fortresses, three castles, and three camps have been taken; and in these 195 standards, 11 horse-tails, and 313 pieces of artillery. Eight pachas and 8000 soldiers have been taken prisoners."

§ This individual was rewarded by the Russians with a princely residence at Odessa, but died in the following year.

We consequently find a Russian squadron, early in the spring, sweeping the western shores of the Euxine, destroying the Turkish batteries, capturing her vessels, and ravaging her coasts. On the 28th of February they landed troops and took possession of Sizeboli, and though a vigorous effort was made by Hussein Pacha to retake this fort, he was driven back with great loss. An attempt to carry Varna by a coup-de-main was also contemplated, but anticipated by the Russians, under general Roth, surprising the Turkish camp, which was followed by a sanguinary action, without any decided advantage, however, on either side.

Before opening the campaign of 1829, the commanders in chief of both armies were suspended. General Diebitsch succeeded count Wittgenstein; and the new grand vizier was supplanted by Redchid Pacha, who had long commanded in Greece.

General Diebitsch commenced his operations on the Danube by the investment of Silistria, on the 17th of May, after defeating a corps of Turks and taking two redoubts. He also secured his communications by a line of posts with Bazardjik and Varna. About the same time, the grand vizier, Redchid Pacha, left Schumla, with the intention of attacking the fortified town of Pravadi. At Eski Arnautlar he fell in with a Russian detachment of 4000 men, who defended themselves bravely for five hours against four times their number, till fresh troops came to their assistance, when the Turks were compelled to retire. Being joined by a strong reinforcement, Redchid returned to the charge, and endeavoured to turn the left flank of the Russians. Here he was opposed by general Roth, when, after some hard fighting, he abandoned the enterprise with the loss of 2000 men, and returned to Schumla. In the beginning of June, however, the grand vizier succeeded in making a regular investment of Pravadi with 40,000 troops. General Roth, finding himself unable to make head against such a force, solicited reinforcements from the commander-in-chief. Count Diebitsch, who was then prosecuting the siege of Silistria, left that operation in charge of his second in command, and proceeded in person at the head of the reinforcements, with a determination to force the Turks to a general battle. With this view, he cut off their communication with Schumla, by occupying the defiles and passes in their rear, by which they drew their ammunition and supplies from that fortress; and the grand vizier was not aware of his approach till he beheld the Russian columns advancing to the attack. A most sanguinary combat ensued, which continued for four hours, when the fire from the exhausted troops wholly ceased on both sides. Redchid Pacha then prepared to fall back upon Marash; but Diebitsch was resolved upon his complete defeat; and having made some new arrangement of his forces, returned to the charge before the Turks had commenced their retreat. The accidental blowing up of their ammunition wagons so intimidated the Ottomans and disordered their ranks, that, after discharging their artillery, they gave way on all sides, abandoning their camp, with 40 pieces of cannon, and all their ammunition and baggage. Sixteen more cannon and many prisoners were taken in the pursuit, and so thorough was the rout that, with the exception of some cavalry who fell back upon Aidos, the Turkish army was entirely dispersed, and the grand vizier reached Schumla by a circuitous road, attended only by a small escort of cavalry. This complete defeat, which decided the fate of the campaign, must be attributed entirely to the skilful and judicious movements, and the admirable plan of attack of count Diebitsch, who, by surprising the grand vizier, while he thought himself in perfect security, and by cutting off his communication with Schumla, accomplished such a thorough dispersion of the Turkish forces, as prevented them ever rallying again for the purpose of opposing his advance; and of 40,000 combatants not above one-third reassembled after the engagement. Count Diebitsch, immediately after the battle, sent a pacific communication to Schumla by M. Fonton, a councillor of state, who returned with the answer, that the grand vizier had received his despatches and proposals, and had sent them to Constantinople for the decision of the sultan.

While count Diebitsch was triumphantly advancing towards the Balkan, Silistria capitulated after practicable breaches were made in the ramparts, and the Russians were ready to storm. Two pachas, 8000 soldiers, 220 pieces of cannon, and 80 standards fell into the hands of the victors; and the besieging corps hastened to join the army under count Diebitsch, who had now resolved to cross the Balkan. Leaving a sufficient force for the observation of Schumla, he proceeded with his army in three divisions, the right column commanded by general Rudiger, the left by general Roth, and the centre by count Pahlen, with whom was the commander-in-chief. The Turkish forces, which they encountered on their route, were so panic struck at the appearance of the Russians surmounting those heights which they had always considered as the impregnable bulwarks of their empire, that they became irresolute, and gave way on the first fire, their officers generally setting them the example. Except some smart skirmishes, therefore, at Kamabat and Selimno, count Diebitsch continued his uninterrupted and victorious march by Aidos, Bourgas, and Kirk-Kilissa to Adrianople. This city, from its situation, its fortifications, and its numerous garrison, might have maintained a protracted resistance; but the Turks were prepared for submission, and despatched a proposal to the Russian commander for an immediate capitulation. The arms and artillery, with the magazines of provisions and ammunition, were delivered up to the enemy; and the Turkish pachas, with their troops, were allowed to return to their homes, provided they did not take the road to Constantinople.

Count Diebitsch entered Adrianople on the 20th of August, and fixed his head quarters in the palace of the sultans, which had been previously prepared for the reception of Mahmoud; and the conquest of this city, according to the Russian bulletin, "was more like a popular festival than the occupation of a capital city by an armed hostile force. The Turkish as well as christian inhabitants continue their usual occupations. The shops and coffee-houses are open, and the local authorities and tribunals have not been interrupted in their proceedings."

The intelligence of the occupation of Adrianople, and the advance of the Russian army on the road to the capital, produced an instantaneous change in the councils of the porte. Mahmoud, who probably trusting to the interference of the other European powers in his behalf, had hitherto contemplated the progress of the enemy with a firm determination to resist to the last, and had even refused to answer the propositions of count Diebitsch after the battle of Pravadi, was now brought to the alternative of negotiation, or exposing his capital to be occupied by a victorious army. The reis effendi accordingly, having conferred with the British and French ambassadors, and the Prussian general Muffling, respecting the means of averting this latter calamity, plenipotentiaries were despatched to the Russian head quarters, with full powers to treat respecting the indemnities to be awarded to Russia for the expenses of the war. When count Diebitsch inquired what propositions the plenipotentiaries had to make, they answered that the sultan left it entirely to the discretion of the emperor of Russia to make his own terms, upon which the count signed the armistice on the 27th of August, and hostilities ceased.

The terms of the treaty were consequently dictated by the conquerors. With a great show of generosity, and after a pompous enumeration of the conquests which she restores, which, except a small territory in Asia, comprises all that was taken during the war, Russia stipulates for commercial rights in favour of her subjects altogether incompatible with the freedom of commercial legislation in an independent state; and also declares, that any infraction of these rights shall be considered as a violation of peace, and as a declaration of war by the porte. The indemnities demanded by Russia are 1,500,000 ducats of Holland for the commercial losses sustained by Russian subjects, in consequence of the measures adopted by the porte respecting the navigation of the Bosphorus; and a further sum as a reparation for the military expenses to which Russia had been put in carrying on the war, the amount of which to be afterwards regulated by mutual consent. The porte adheres to the stipulations of the treaty of London, concluded on the 6th of July 1827, between Great Britain, France, and Russia, and also to the Act drawn up on the 22d of March 1829, by the same powers: and which respect the independence and boundaries of Greece. It also agreed, that additional clauses to antecedent stipulations considered necessary to secure the principalities of Moldavia and Wallachia in the enjoyment of their rights, shall be inscribed in a separate act.

The separate articles respecting the principalities were signed on the same day, and amount to a virtual surrender of these provinces to Russia, who will at no distant period find a pretext for attaching them to her own empire. They bear that the hospodars shall receive their appointments for life; that the porte shall protect the rights and privileges of these provinces against any encroachments of the neighbouring pachas; that these provinces are to be exempted from paying contributions in corn, provisions, cattle, or timber; in place of which an annual tribute shall be paid to the porte, and a *pro tempore* tribute at the death of every hospodar; and that Turkey shall have no fortified points on the left bank of the Danube, nor permit any of her Mahometan subjects to settle there.

With respect to the secret articles regarding the indemnities, it is stipulated that the indemnity of 1,500,000 ducats for commercial losses shall be paid within eighteen months, in four different instalments; that 100,000 ducats shall be paid upon the ratification of the treaty; 400,000 six months after; 500,000 in other six months; and the remaining 500,000 at the conclusion of the eighteen months. Upon the payment of the first instalment, and the execution of the article respecting Servia, which is contained in the convention of Ackerman; and the delivery of the fortress of Giurgevo, the Russian army shall within a month evacuate Adrianople, Kirk-Kilissa, Burgos, &c. Upon the payment of the second instalment, the Russians shall retreat over the Balkan; and that Bulgaria, with all the towns between the Danube and the Euxine, shall be evacuated on the payment of the third instalment.

The military indemnity is fixed at ten millions of ducats, to be paid in such a manner as the emperor of Russia shall determine *on an appeal of the porte to his generosity and magnanimity;* and in order to render this payment as easy as possible, Russia consents to take in part payment an equivalent in such goods as may be agreed upon. But until the entire payment be made, the Russians shall hold the fortress of Silistria and the principalities of Moldavia and Wallachia.

In reviewing this treaty, we can regard it in no other light than a hollow truce. The interests of the Ottoman and the Muscovite can never amalgamate. By a series of regular and successful encroachments, Russia has been extending her frontiers southward, and will not stop until she has the Mediterranean for her southern boundary. The porte stands in the way of this favourite project, and his safety depends upon resisting it to the utmost; but for the last century he has never come in collision with his powerful adversary without the loss of territory or influence. The Ukraine first excited the cupidity of the Muscovite; next the Crimea; and then Bessarabia with the boundary of the Pruth. He has now reached the Danube: his next boundary will be Mount Hæmus; and then the Sea of Marmora and the Ægean sea.

Greece however, it is to be hoped, is now for ever beyond the grasp of Russia. Her repeated endeavours to stir up rebellions in that country by her emissaries and her gold, though always accompanied with the promise of freedom to the Grecian chiefs, were uniformly prosecuted merely with the selfish view of creating a diversion in her own favour when at war with the porte; for whenever her purposes were accomplished, the deluded Greeks were left to their fate; and consequently every attempt to throw off their Turkish fetters served only to make their oppressors load them with heavier chains. Gladly, indeed, would the Czars have converted this beautiful country into a Russian province, and would willingly have bartered for it the richest jewel in their crown; but their ambition and cupidity have hitherto been restrained only by the difficulty of the enterprise.

The same selfish policy has dictated the present interference of the Russian autocrat in the liberation of Greece. It cannot be presumed that he, who lords it over a nation of slaves, can have one feeling in common, in such a cause, with the enlightened sovereigns of Great Britain and France, who rule over free-born men. His uniform object has hitherto been territorial aggrandisement and political influence; and his admiral, count Heyden, when he prevailed upon his colleagues in command to destroy the combined fleet in Navarin, had in view ulterior measures, which these officers could not have contemplated. Great Britain and France, by thus admitting the interference of Russia in obtaining a favourite measure, have enabled her to reward herself with a princely remuneration; for we have no hesitation in maintaining, that it was to the destruction of the Turkish fleet, and to the dissolution of the Turkish janissaries, that Russia was mainly indebted for her ultimate success in her conflict with the Ottoman porte. Had this fleet been preserved for the defence of Varna and the coasts of the Euxine, the Russian army would never have crossed the Balkan; or if it had, and the disbanded janissaries of Adrianople had been true to their country's cause, instead of harbouring resentment against their prince, count Diebitsch, deprived of supplies and reinforcements by sea, would in all likelihood have experienced the fate of Peter the Great on the Pruth, at Falczi. Russia, however, is now triumphant, and she may insist upon her adversary paying the uttermost farthing of his bond; but torrents of blood must flow before her plans of aggrandisement be completed; and she may perhaps never again find such a union of circumstances so favourable to her views. She may have also learned, from her own practice and experience, that a treaty made in the hour of peril is considered no longer obligatory when the danger is past; and the present ruler of Turkey will not let slip any opportunity of retaliating upon the foe of his house the wrongs and injuries which have been accumulating for a century.

If Turkey is to be renovated, and to be brought within the pale of civilized Europe, no prince of the line of Othman has ever appeared with qualifications and attainments better suited to its circumstances and its wants than its reigning sultan. Mahmoud II. is at present in the prime of life, being about thirty-six years of age; and the important changes which he has already effected, namely, the annihilation of the turbulent and seditious janissaries, and the subjection of the ulema and pachas to the obedience of the laws, testify his unshrinking courage and resolution. Upon the occasion of the unfortunate battle of Navarin, when all Europe seemed banded against him, his calmness and prudence, though severely tried, did not forsake him; and he evinced a spirit of justice and forbearance very unusual in any prince of his line, in his treatment of foreign merchants, who, while they looked for the usual measures of confiscation and the bowstring, were generously protected in their lives and property. Though conquered, Mahmoud still perseveres with unabated zeal in completing his plans of reform in the military and naval services, and in preparing his empire for future emergencies. By the introduction into his army of European discipline and tactics, and by his own adoption, on many occasions, of the European costume and manners, so obnoxious to the pride and superstitions of Mussulmans, he has shown himself superior to the keenest prejudices of his nation, and is thus gradually freeing himself from the authority of those ancient forms and opinions by which his predecessors were held in thraldom. He has already done much for the advancement of his people in civilization and happiness; and the condition of slaves throughout his dominions has been so considerably ameliorated during his reign, that they enjoy more freedom and comfort than the serfs either of Russia or Hungary. We are afraid, however, that, owing to the vicious structure of society in this country, the religious prejudices and fanaticism of the people, and their general inaptitude for improvement, the task of renovating Turkey will prove too Herculean even for Mahmoud. In the following extract from a recent work on Turkey, the sultan is described as unremitted in directing and managing the affairs of his government: "Il surveille son Divan avec un soin extrême, et ne lui laisse que le simulacre du pouvoir; il dirige, il regle tout par lui-même; en un mot il est lui seul le gouvernement. Mieux et plutôt informé que les ministres au moyen d'une agence secrète três-active, ses mesures sont prises avant que les rapports de son Grand Vizier lui soient parvenus. Actif, laborieux, d'un secret impénétrable, observateur zélé de sa religion, fidêle à sa parole, sobre et respectant les mœurs, Sultan Mahmoud peut être regardé á juste titre comme un phénomène pour la Turquie." See Knolle's *Turkish History;* Thornton's *Present State of Turkey;* Eton's *Survey of the Turkish Empire;* Upham's *History of the Ottoman Empire;* Malte-Brun's *Geography*, vols. ii. and vi.; *Foreign Review*, Nos. 1, 3, 5, and 6; and *Annual Register*, vols. xiii.—xix.

TURNING.

§ 1. Under this head we comprehend all operations performed in the turning lathe, in which the object operated on is so disposed as to revolve round its axis, while a cutting instrument is applied to it; or in which it is successively fixed in different positions of its rotation, and then operated on by instruments of various kinds, moving in circles, in portions of circles, in other curves derived from circular motion, or in straight lines.

§ 2. The art of turning in its simple form is of great antiquity, and is susceptible of more accuracy than almost any other mechanical operation. We shall not attempt to give any description of the manipulations required in its application in the more common cases, as these cannot be well learned but by practice, under the guidance of an experienced artist.

§ 3. The great demand for accurate workmanship which has been occasioned by the improvement of the steam engine, and the consequent extension of machinery and manufactures, has led to important improvements in the art of turning. Of some of these we shall endeavour to give such a description as may convey to artists who may not have had an opportunity of seeing their application, some idea of the effects which may be obtained by means of them.

§ 4. The most important of these improvements on the old method of operating by hand-tools, and that on which most of the other improvements are founded, is what is commonly called the slide-rest. This, in what is called ornamental turning, is a small apparatus which is occasionally fixed in the socket of the ordinary rest, (having a cylindrical stalk for this purpose,) consisting of a cutter holder, or carriage which slides along a narrow platform, and is regulated in its motion by a leading screw, which has a small winch, or a milled and divided head at its right-hand extremity.

§ 5. In the best construction of lathe for working in metals, the arrangement is different. The foundation of the slide-rest is a sole A, (Plate DXXVII. Figs. 1, 2, 3, and 4,) which can be fixed at any required part of the bar or bed between the two heads of the lathe. On this sole there is a solid plate B, which slides in a path adjusted truly at right angles to the line of the axis of the spindle or mandril: on this sliding plate, another solid plate C is attached (in a way which will be mentioned afterwards), and on this plate C is formed a slide at right angles to the first one, (and consequently parallel to the axis of the spindle.) On this slide a piece D (sometimes called the saddle) moves; this saddle has an excrescence E rising from its upper surface on that side which is nearest to the spindle of the lathe; it is bored out cylindrically, and forms the socket in which the stem or stalk of the cutter or tool-holder is fixed by a pinching screw G, in the same way as in the sockets of common rests. This socket should be bored truly perpendicular to the planes of the slides.

§ 6. The sliding plates mentioned above are each moved in its own path by a leading screw turned by a winch handle,* and it will be obvious that by turning the winch of the leading screw, that plate, with every thing on it, (including the socket E and cutter holder F,) will be made to advance or retire in a direction perpendicular to the axis of the spindle, or of the article to be turned, and that, by turning the winch of the upper leading screw, the saddle D, with the socket E, and cutter holder F, must move in a path parallel to the axis of the lathe, or of the work, and therefore that the article turned must necessarily assume the form of a cylinder. By a combined simultaneous motion of both winches, the point of the tool may be made to pass through any assignable line in a plane parallel to the slides.

§ 7. As, however, it is often necessary to turn conical objects, an adjustment is provided in the construction of the rest which facilitates the performance of this operation with extreme accuracy.

It was mentioned above, that the upper and lower sliding plates B and C are attached to one another in a particular way, which is this: a solid cylindrical pin H passes vertically through both plates near their middle; this pin is screwed into the upper one, but passes through a well-fitted cylindric hole in the lower one B, and so forms a joint round which the upper slide may be turned when the screw is slackened; the edge of the upper plate which is nearest the workman, is a portion of a circle of which the above mentioned joint H is the centre, and is divided into degrees, and marked in such a way that, when the two slides are truly at right angles to one another, the division marked zero is at the index, and the other divisions marked 10°, 20°, &c. on the right and left of zero. When it is required to turn a cone of any particular angle of inclination, the upper plate is turned to the right or left until the corresponding number of degrees comes to the index; it is then fixed in that position by its pinching screws. If the winch of the upper leading screw be now turned round, the point of the tool will describe a straight line having the required inclination to the axis of the work, and so will turn either an external or internal cone according as the cutter and the work may be disposed; *ex. gr.* the key and the socket of a brass cock may be turned in this way with such perfect accuracy that the one, on being dropped into the other, will be perfectly water-tight without much further preparation or grinding.

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* In some sorts of work, such as the cutting of teeth of wheels, and drilling deep holes, it is more convenient to take out the leading screws, and to work the slides by levers.

§ 8. The great advantages which this construction has over the old one is, that when once well adjusted, it may be successively applied at different situations without any fresh examination or adjustment; and that, as the socket partakes of the regulated movements of the slides, every instrument or piece of work which is put into that socket, becomes subject to these movements.

§ 9. If, therefore, instead of putting a simple cutter holder (like F Fig. 1 or 4) in the socket, we put any instrument capable of producing a particular effect by a motion of its own, this instrument may (by means of the movements and adjustments of the slides) be made to produce its effect on any particular parts of the work, either in continuous lines, or in parts in a regulated succession, as the work (which will remain fixed while the instrument is operating) may (by means of a divided plate on the face of the spindle pulley) be presented successively in any required number of positions.

§ 10. One of the most useful of the instruments which may be so applied, is a drilling apparatus. Let the reader suppose that a frame containing a strong drill mandril A is so constructed that when it is fixed into the socket of the slide rest, the axis of the mandril is parallel to the path of the *lower* slide,* and that by some proper arrangement of bands and pulleys this drill stock can be made to turn with the requisite velocity; next let him suppose a drill in the stock, and a cylindric piece of work in the lathe, then if the pointer be applied to any of the holes in one of the circles, in the face of the pulley (of the spindle) having twelve divisions, one or other of the following effects may be produced.

1st case. If, while the drill mandril is revolving, the winch of the lower leading screw be turned forward, the drill will advance and will continue to pierce a hole towards the axis of the cylinder. If the drill, after going to a certain depth, be withdrawn clear of the hole, and the work be turned round until the pointer falls into the next hole in the divided circle of the pulley, the drill may be again advanced to perforate a second hole, and so on until the number 12 is completed. In this way sockets for the spokes of a wheel may be accurately bored, or any analogous operation may be performed.

§ 11. 2d case. But with the same preparation a different effect might have been produced. After the first hole had been made, if instead of turning the piece of work in the lathe 1-12th part of a circle, we had turned the winch of the upper leading screw a certain number of turns, and then had drilled a second hole, and if we repeated this alternate operation 12 times, we should then have had 12 holes as before, but with this difference, that they would now be disposed in a straight line parallel to the axis of the cylinder.

§ 12. 3d case. Again, with the same preparation, a third effect may be produced. Suppose the first hole pierced as before, and the drill withdrawn from it, then if the work be turned round 1-12th of a circle, and also the upper winch turned as many turns as in the second case, the second hole, when made, will be found to stand diagonally to the first; and if the operation be repeated 12 times in the same way, the 12 holes will have taken a helical direction round the cylinder, and if short spokes were fitted into them, they would stand like what are called the pins of a wiper beam.

§ 13. 4th case. If the drill, instead of being allowed to penetrate so far as to make a hole, were stopped in its advance when no more than its cutting part had entered the substance of the work; and if, while in this situation, the winch of the upper leading screw were to be turned (the drill still continuing to revolve), its point would necessarily cut away the substance of the work in the direction in which it was led by the screw, and would in this way cut a longitudinal furrow instead of a circular hole. The shape of the bottom of this furrow would depend on the form of the point of the drill.

§ 14. In these four cases we have supposed the drill to be capable of drilling holes only at right angles to the axis of the work, but this would obviously be too limited a range of operation. It is necessary, therefore, to have some means of advancing the drill arbor independent of the action of the lower leading screw, and this is done by having a slide B in the construction of the instrument itself, as seen in Fig. 5. This slide is parallel to the axis of the drill arbor, and as the instrument, when put into the socket of the slide rest, may be set with its own slide obliquely to the work (having divisions and an index as at C for this purpose), the advance of the drill *into the work* may be made in any required direction, while its other movement will depend as before on the leading screws of the slide rest.

§ 15. The term *drill* has been used here to designate the cutting part of this instrument, but this must not lead the reader to suppose that the form of the cutting tool is limited to that usually seen in boring instruments. *Revolving cutter* would be a better designation, were it not appropriated to another instrument, of which we shall have to speak presently. In point of fact, an endless variety of cutters may be employed in a well constructed apparatus of this kind, and effects may be produced by a judicious application of them, which, until lately, were never attempted by the turner. The nose D of the arbor may be screwed like that of the spindle of the lathe, and by means of metal chucks (similar to that shown at N, Fig. 2, Plate DXXVI.) fixed on it, eccentric cutters of various kinds may be employed according to the wants of the artist; this will be understood by inspecting the figure. We cannot, according to our prescribed limits, go further into the detail of the adaptations of this useful instrument than just to show, by way of example, how it may be employed to produce flat surfaces in different parts of the same piece of work.

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* In Fig. 5 the drill mandril has been represented in a position parallel to the path of the upper slide, and to the axis of the lathe, *i. e.* in a position for drilling face work.

§ 16. Let us suppose we have turned a sphere of ivory from which we want to cut away such portions as would leave a cube. It is obvious that in the old way of turning by, by making the work revolve and the tool remain comparatively at rest, that only one of the six faces could be cut in this way without removing the work from the chuck; and that the greatest possible accuracy in refixing it after removal, could hardly ensure a successful result.

§ 17. By means of the instrument just described, the whole six faces may be prepared without unfixing the work from the original position in which it was made into a sphere. We shall suppose, then, that the sphere is attached to the chuck by a neck strong enough to bear the operation of cutting the planes, and that we have ascertained the exact length of the side of the cube contained in the given sphere. The first thing to be done is to select some circle on the pulley of the lathe spindle divisible by 4, into one of which divisions we fix the pointer. We then choose an eccentric cutter for the drill arbor, similar to that seen in Fig. 2, Plate DXXVI. the sweep of which must include a circle whose diameter is something greater than the side of the intended cube: the form of its cutting edge is not very material in the first stage of the operation. The slides of the rest, and of the drill apparatus being set accurately at their respective zeros, and the arbor itself being somewhat to the right hand of the piece of work, it must be set in motion by the band, and carried to the left by the upper leading screw until the cutter just begins to impinge on the surface of the sphere. The depth of cut is of course to be regulated by the lower leading screw, and should not exceed 1-40th or 1-50th of an inch each time; in this way, by making the cutter repeatedly pass from right to left over the face of the sphere, advancing the lower slide each time by the depth of a fresh cut, one face of the ball may be cut down *nearly* to the required depth. The index point is then to be made to fall into another quadrantal division, and the same operation repeated *to the same depth*, and so on with the two remaining ones. When the first face has been cut away, the plane face will be bounded by a circular line; but when a second has been cut, the intersection of these two planes will form a straight line which should, in this stage of the operation, be *a little shorter* than the side of the intended cube. A new very sharp cutter should now be fixed in the chuck of the drill arbor, having its cutting edge straight, and truly at right angles to the arbor; with this the same operation must be repeated on all the four faces, until the lines of intersection of the four planes be exactly equal to their breadth, and the planes themselves perfectly smooth. Instead of the eccentric cutter, a cutter like a small circular saw might have been fixed on the nose of the drill arbor, and the four lenses cut off the sphere in succession, but the same smooth finish could hardly be given in this way, and the diameter of the saw would require to be more than twice the size of the cube to enable it to cut off the slice without the neck of the arbor interfering, the friction would consequently be great.

§ 18. The drill apparatus must then be removed from the slide rest, and the pointer from the divided circle, so as to leave the lathe and work free to revolve. The ordinary cutter or tool holder is then to be put in the socket of the rest, and furnished with a well set parting tool. This tool is to be brought by the leading screws to the proper position for making a cut perpendicular to the axis of the work at the right hand extremity of the intended cube; the *work* being then put in motion, and the tool advanced by the lower winch, a fifth plane will be cut on the end of the work, and a slice of the form of a plano-convex lens will be cut off; this face being completed, either at one or at repeated cuts, the place of the tool holder must be shifted by the upper leading screw, to permit the cut to be made which is to form the sixth face, and of course to detach the cube from its connexion with the mandril.

§ 19. It will be evident to the reader that if the operation be conducted with proper caution, and the divided circle on the pulley be accurate, the result must necessarily be an accurate cube. The intelligent artist will also see, that by a slight variation of the process other geometrical solids may in like manner be produced, and many analogous operations performed.

§ 20. We mentioned above that the name of *revolving cutter* was appropriated to another instrument which may (like the drill apparatus) be applied in the socket of the slide rest. When a lathe is provided with well divided circles on the pulley of its mandril, and a properly constructed revolving cutter apparatus, it becomes an engine of extensive powers for cutting the teeth of wheels.

This instrument consists of a frame carrying a spindle A, generally vertical, but which may be set (within certain limits) at any degree of obliquity in a vertical plane, and round a centre which is in the plane of the axis of the lathe. In all the positions which it can assume, except the horizontal, its lower extremity or point B is below, and its upper collar or neck C is above the plane of the centres of the lathe. At a point between the pivot and collar, and exactly level with the lathe centre (and consequently with the centre of its own adjustment) circular cutters (as at D) like those of a clockmaker's engine, may be fixed on the spindle. Let us suppose the spindle in the vertical position, fitted with a cutter, and a piece of work in the lathe in which it is required to cut 120 teeth. It will be seen that all we have to do is to bring the revolving cutter directly opposite the edge of the work, to select a circle on the pulley of 120 divisions, and having fixed the pointer in the first division, to advance the cutter against the work by the lower leading screw to the proper depth. This being repeated for each of the 120 divisions, the operation is completed. If, instead of a thin wheel, the work be a pinion of considerable length, it may be necessary, after having made the first cut to the proper depth by means of the lower leading screw, to extend the cut to the right or left by means of the upper one; in such cases, it is best to make all the cuts after the first, by means of the upper winch alone, winding the cutter clear of the work each time to allow for the shift being made in the divided circle.

§ 21. We have said that the cutter spindle may be set obliquely, or even horizontally. This is effected by making that part of the frame, in which the step and collar of the spindle are formed (see E, Fig, 6, Plate DXXVII.) turn on a centre which passes through the portion of the frame which is fixed in the socket of the slide rest. This centre is level with the centres of the lathe, and consequently, whatever angular position the spindle may be put in, the circular cutter will always tend to cut directly towards them.

§ 22. Many operations besides the cutting of the teeth of wheels and pinions may be performed by this apparatus, as the form of the cutters, the position of the spindle, and the movement to be given to them may be varied in many ways by the intelligent artist, according to the purpose he has in view.

§ 23. In all the cases subsequent to § 9, we have supposed the work or article operated on to be fixed in the lathe (by means of chucks or otherwise) and the cutting instrument to be in rapid motion round its own axis. There are cases, however, in which the situation of the work and the tool may be reversed, the work may (by different methods according to circumstances) be fixed in the slide-rest, and the tool may be fixed in, or on, the nose of the lathe mandril.

§ 24. In this way a piece of wood or metal which is to be sawn in parallel cuts, or cuts at certain inclinations to one another, being properly made fast to a frame or vice held in the socket of the slide-rest, we may cut it in a variety of planes by a circular saw fixed on the lathe mandril, because by means of the divided arch on the upper slide of the rest, we may set it to the required angle, and then by the lower winch we may advance it against the edge of the saw.

§ 25. Instead of a circular saw, we may put drills of large sizes into the lathe mandril, and fixing the article to be bored on the slide-rest, we may present it, and advance it against the drill by means of the leading screws. This process will often be useful when the drill is large, and the resistance too great to be conveniently overcome by the apparatus described in § 10, &c.

It may sometimes happen that the risistance is too great to be easily overcome by the leading screw of the upper slide. In this case it may be as well to disengage the leading screw and winch, and to bring the moveable head of the lathe so close to the work, that the upper slide, together with the work on it, may be pressed towards the drill, by the screw of the right hand head stock.

§ 26. We have endeavoured in the foregoing paragraphs to give some indications of what may be done in a lathe with a well constructed slide-rest. The intelligent artist will see that by some of the contrivances pointed out, or by some modification or combination of them, he may perform with comparative ease, and great precision, many operations which, in the ordinary way, must be done in the vice by chipping and filing; and which would consume much time even in the hands of the most expert workmen. In good slide-rests there are stops and adjusting screws for regulating the depth and length of the cuts. We have not attempted to describe them, as this would lead us into too minute a detail. Some of them may be seen in the engravings.

§ 27. In machine maker's work-shops, where heavy work is turned, such as shafts, large rods of steam pistons, &c. the slide-rest is differently constructed, and is more strictly what its name indicates. Instead of a part of it being fixed to the bed, and the saddle with the cutter holder being made to slide on it by a leading screw within itself, the whole body of the rest is made to slide to the right or left along the bed of the lathe, sometimes by an endless screw within itself, which works into a kind of oblique toothed rack, extending all along the bed, and sometimes by a leading screw of the length of the bed which works in a female screw socket in the sole of the rest. This leading screw is worked by wheel work from the lathe mandril, and the requisite degree of speed is given to the motion of the rest by proportioning the sizes and numbers of the wheels, pinions, and pulleys.

§ 28. By this last arrangement, a very convenient method is obtained of cutting long screw bolts, or original screws of every variety of pitch, as we have only to put on such trains of wheels and pinions as we ascertain by calculation to be necessary to give the relative degrees of velocity to the mandril and to the cutter in its motion to the right or to the left, and we shall then, by presenting a cutter of proper form, succeed in cutting a screw of any length which the lathe can take in. If the cutter moves to the *left* while the work revolves the right way, it will cut a right hand thread; and if it move towards the *right*, while the work is revolving the right way, the result would be a left hand thread of the same pitch. The thread will be angular, square, or round, and deep or shallow, according to the form of the cutter which may be selected.

§ 29. The female screw or nut of the same pitch may be cut in two ways.

1st. The work to be screwed may be chucked, and a hole of the proper size having been bored in it, a side cutter being presented either at the mouth of the hole, or at its bottom (according as the thread is to be a right or left one) the lathe being then put in motion, the tool will advance or retreat (as the case may be) while the work turns round, and the thread will be gradually cut to the proper depth.

2d. If the work be of such a nature that there are a succession of holes to be tapped, it may be fixed on the slide-rest, and one of the holes brought truly into the line of the centres; then by means of a revolving cutter (of one point) fixed in the lathe mandril, the thread in the hole may be gradually cut to the required depth by increasing the eccentricity of the revolving cutter at each shift of motion. The other holes in the work must then be brought in succession (by means of the slides of the rest) into the line of the centres, and the same process repeated.

In this process, the motion of the lathe mandril should be slow, say 25 to 30 turns per minute, according to the substance operated on and the diameter of the work.

§ 30. It is sometimes required to have a projection on a portion of a surface which in other respects is to be cylindrical, *e. g.* a feather on the side of an arbor, to enable it to carry round something which may be fitted on it. In such cases, if the feather or projection is to be short in proportion to the whole length of the work, the circumference of the work at the place of the projection may be brought to an uniform surface with the rest of the work, by the revolving cutter described in § 20. To do this, the apparatus should be furnished with a plain cutter, and made to cut to the proper depth, at the root of one side of the projection; when it has done this, the lathe mandril should be turned slowly round by hand (the cutter at the same time continuing to revolve rapidly), and by this means the extra matter on the surface of the work will be gradually cleared away, until the opposite side of the projection which is to be left has been brought round to touch the cutter. The apparatus should then be shifted a little to the right or left, and the operation repeated until the work be complete.

§ 31. If the projection extend considerably in the direction of the axis of the work, this method would be tedious, owing to the great number of shifts of position required to be given to the cutting apparatus. Another method is therefore had recourse to, which leads us to describe a very important implement in machine making. It is called the *planing engine*, and has been but recently introduced into some of the best workshops in this country. This implement may be said to be the greatest gift made by ingenuity to the useful arts, since the invention of the common turning lathe, as it holds the same place in relation to the formation of straight lines and plain surfaces, which the turning lathe does to lines and surfaces of revolution.

§ 32. We shall proceed to give a description of this important machine. Plate DXXVI, Fig. 1, is an isometrical perspective view of a planing engine of medium size. A is a strong bed of cast iron, the general form of which may be varied according to circumstances, but it must have two angular ridges B dressed truly parallel, and in the same plane relatively to one another. On these ridges lies a table C, having two grooves corresponding to the ridges B, and its upper surface planed flat and parallel to these ridges. To this table a go-and-come motion is given by a winch D and an endless chain. The table is pierced all over with holes to admit the passage of screw-bolts, by which any piece of work to be operated on may be securely fastened down to it.

From the bed A rises a frame E, of which the face ridges *e* are truly perpendicular to the ridges B; each pillar of this frame has a groove, as at *f*, through which pass bolts by which the cross slide frame F is fixed in any required position, parallel to, or at an angle with the plane of the table C.

On F is fitted the tool or cutter carriage G, which has a variety of slides and adjustments which we shall not attempt to detail;—its motion across the plane of the table is regulated by the long leading screw seen at FF,—the depth of the cut of the tool is regulated by a slide in the carriage G, which is also furnished with a leading screw and divided head H. This last mentioned slide has an adjustment by which it may be set perpendicular to, or at an angle with the cross slide F.

§ 33. Let us now suppose a piece of metal of any form, bolted down firmly on the table,* let the cross slide be adjusted parallel to the surface of the table, at such a height above it that the point of the cutter may be made to act on the work; if then the table be moved in the proper direction by means of the winch, it is evident that a groove of the form of the point of the cutter will be made in the upper surface of the piece of metal, and that this groove will be parallel to the plane of the table's motion; if the carriage G be now shifted to either hand by the leading screw F, a second groove will be cut parallel to the first, or if the shift be less than the breadth of the point of the tool, the first groove will have been widened as much as the cutter has been shifted, and by repeating the shift of the screw F, and the motion of C, the groove will gradually become a plane surface parallel both to C and the cross slide F. If the slide F had been adjusted at an angle to the plane of C, instead of being parallel to it, then the plane produced on the work would, in one direction, have been parallel to the table, and in the other to the cross slide.

§ 34. When the angle of obliquity with the plane of the table is not great, the work is easily accomplished by setting the cross slide to the angle required, but when the plane to be cut is perpendicular to that of the table, or is nearly so, the effect must be produced by adjustment of the slides of the carriage G.

§ 35. It is hoped that the action of this engine will now be sufficiently understood to allow of our reverting to what we said in § 31, regarding the most convenient way of forming cylindric surfaces, having feathers or ridges left on some part of their circumference: in order to effect this and some other purposes, the following provision is made in the construction of the planing engine. In the middle of the table C is the grooved passage J, by means of which two head-stocks K (like those of a turning lathe) may be fixed at any required distance from one another: in the one head-stock is a dead centre, and in the other a short mandril turning in a collar, and having a divided plate and index on its outer end. The piece of work being fixed between these centres, and its position duly shifted round them by means of the plate and index, it will be easily understood that the alternate movement of the table and of the work round its centres, will gradually produce a cylinder, or will leave some portions of the surface uncut, accordingly, as may be required; these effects may be further modified by the adjustments of the cross slide and of the carriage

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* The piece of work represented in Plate DXXVI, as being fixed in the engine, will be described afterwards.

G, and by combining their shifts with the movements and shifts of the table C, and of the work in the head-stocks.

§ 36. It appears surprising to us that the ingenious artists who invented, and who employ this beautiful engine in their works, have not added to it that which appears to us would be an important extension of its powers, viz. the means of drilling holes perpendicular to, or at any required angle to the surfaces produced by its action.

If the slide which carries the cutter be removed from the carriage G, and one substituted, such as shown at Plate DXXVI, Fig. 2, where L is a strong arbor, (similar to, but on a larger scale than that mentioned in § 10,) in which drills may be fitted, and M, a pulley of any required diameter, round which a band may be applied to give it motion, then by means of the leading screw of the cross slide and the movement of the winch D, the drill arbor L may be brought over any required part of the work, and a hole may be pierced, which will necessarily be quite true in its direction, without any care or nicety on the part of the workman. Again, if instead of a boring instrument being put in the arbor L, a chuck something like N were screwed on its nozzle, then by means of eccentric cutters like O, circular grooves and valve seats might be cut out, or cross pivots turned, which would be truly at right angles to others which might previously have existed on the work, and which might have been fixed in the centres of the head-stocks KK. Such an apparatus would be eminently useful in making the working gear of steam engines.

§ 37. Various other instruments besides the drilling frame may in the same way be applied, by means of slides, to the carriage G. Ingenious workmen will easily devise such as may be suited to their particular lines of pursuit. We shall, however, venture to suggest one, which, although we have never seen it applied to metals, we think may be so with advantage in many cases of nice fittings, we mean the mortise chisel. If a steel cutter like a mortise chisel were fitted to a slide in the carriage G, and were to be worked up and down by a lever handle of adequate length, while the carriage G itself was gradually shifted by the leading screw F, some operations might be easily and accurately executed, which present considerable difficulties in other methods. It will at once be seen what advantages such processes would afford in the construction of machines, the due performance of which depends much on the accurate adjustment and true bearing of the parts, and we may safely venture to say that by means of the planing engine a gigantic zenith sector or a transit instrument could now be made with greater accuracy by a common workman in a Manchester millwright's shop, than could fifty years ago have been made by the best London instrument maker.

The planing engine which is represented in the plate may be said to be of a medium size. It has been executed by Messrs. Paterson and Mitchell of Edinburgh, for their own use. Some engines are made much smaller, and are applicable to such work as would otherwise be filed in the vice; others again have been executed by Sharp, Roberts, & Co., Messrs. Lilly and Fairbairn, and other engineers in Manchester, on such a scale, that very large pieces of work are planed in them, *e. g.* billiard tables in one casting of 12 feet by 6, which are executed in this way with perfect accuracy.

In Plate DXXVII, Figs. 1, 2, 3, 4, and 7, are drawn to the scale at the foot of the engraving. Figs. 5 and 6 are to a scale of double size.

Fig. 1 shows a slide-rest lathe, calculated to turn light metal work to about 10 inches diameter. The frame KK which rises from the table, is intended solely for working the apparatus shown at Figs. 5 and 6, and described in paragraphs 10 to 22 passim. The drum H is put in motion by a band S from the great wheel below the bed. Its height above the bed should be sufficient to keep it entirely clear of the head of the workman.* The frame II swings on the turned rod J, which screws into the uprights KK; there is another turned rod L, on which a loose pulley M slides; on the lower rod of the frame II are two similar loose pulleys M′M′, and there is a fourth one N on the rod J. When the drilling apparatus at Fig. 5 is put into the socket E of the slide rest, it is set in motion by a band, as shown at PP′: as this band must be long enough to allow of the pulley P′ being moved to a certain distance from the drum H, it becomes sometimes necessary when P′ is near it, to have the means of keeping the band tight; this is done by a small flying pulley at the end of a cord which passes over the loose pulley N, and has a weight at the end of it similar to that at O. The flying pulley is made to bear on the band PP′ to keep it in a due state of tension.

When the apparatus at Fig. 6 is used, the band is applied as shown at QQ′ passing over the loose pulleys M′M′. Tension is given to the band by means of the weight O, which, by a cord passing over M and hooked to the lower end of the swinging frame II keeps it equally stretched, although Q′ may vary its position and distance.

Figs. 2, 3, and 4 are details of the slide rest; the letters of reference are the same as in Fig. 1st.

Fig. 7, is a section of part of the lathe mandril and its pulley, AAA the grooves for the band, B′B show a groove or channel wider at bottom than at top, in which the heads of two screwed studs can travel round: these studs may be made fast in any required situation by pinching the screws; one stud and screw is shown separately at B″. If they, for example, were made fast in their places at 90°, or a quarter of a circle apart, and if the pointer R, Fig. 1st, were inclined inwards, until its pin touched the outer edge of the groove, and were then made fast, it is plain that the mandril, instead of turning freely round, could turn through a quarter of a circle only, as the studs would, by striking on the pin of the pointer R, prevent it from going farther in either direction; by this means any required portion of a circumference may be operated on without risk of going too far or making unequal arcs in different parts of the work. The studs are introduced into the channel through the opening C from the concavity of the pulley.

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* From the nature of the perspective, the frame and drum appear lower than they should be.

Fig. 8, is a convenient form of a throw chuck, in which the pin A can be made to project more or less, and be fixed near to, or far from the centre, by one pinching screw nut D; the pin A fits neatly in the sliding piece B, the front part of which is sawn through, and the back part screwed. A washer C is interposed between the nut D and the back of the chuck. When the nut D is turned to the right, it draws B between the dove-tailed sides of the slide E, by which A is jammed, and becomes immovable, until relieved by slackening the nut D.

The above designs have been taken principally from lathes made by Drane of Birmingham, whose accuracy and ingenuity are conspicuous in every thing which proceeds from his manufactory.

In the 46th volume of the Transactions of the London Society of Arts, designs and minute detailed descriptions are given of an excellent lathe for machine-makers' purposes, by Clements of London. We venture to recommend it as a good study for artists.

The best makers of turning apparatus we happen to know are as under.

For very large work—Messrs. Lilley and Fairbairn, and Messrs. Sharp, Roberts, & Co. of Manchester.

For medium and light work—Mr. Drane of Birmingham, and Messrs. Paterson and Mitchell of Edinburgh.

For such turning lathes and apparatus as are required by amateurs—Holtzapfel and Deyerline of Charing-Cross are unrivalled for the high finish and elegance of their work. We have also seen amateur's lathes made by Drane of Birmingham, which, in point of accuracy and efficiency, could not be exceeded.

It may be expected that we should give some idea of the cost of such apparatus as we have described, but this is very difficult, as there is so much variety in the nature of the accompaniments required by different individuals. We shall however quote the prices of such as are sometimes used by the best machine makers.

A 16 inch slide lathe capable of turning cylindrical objects, 13 feet long and 13 inches diameter, or flat objects 24 inches diameter, with traversing and reversing apparatus for the main slide; cross slide for flat surfaces, and driving apparatus for five different degrees of speed—costs about £275.

A 12 inch lathe, with compound slide rest, eccentric lock rest and driving apparatus—£105.

A planing machine, capable of planing objects ten feet long, three feet wide, and three feet high, and surfaces at any internal or external angle, with driving apparatus complete—£285.

The additions to this machine, suggested in paragraph thirty-five and thirty-six would add but little to its cost, and would greatly extend its powers.

The machines here specified are formed entirely of metal, and are finished and adjusted with the most scrupulous accuracy.

TURNIP, Husbandry. See Agriculture, *Index*. See also France, Vol. IX. p. 411.

TURNSOL. See France, Vol. IV. p. 414.

TURPENTINE. See Chemistry *Index*. Materia Medica, Vol. XII. p. 430.

TURPENTINE TREE. See France, Vol. IX. p. 420.

TURQUOISE. See Mineralogy *Index*, and France, Vol. IX. p. 401.

TUSCALOOSA, or Black Warrior, river of Alabama, the great northeastern constituent of Tombigbee, is formed by two branches, Locust and Mulberry Forks. Locust Fork rises in the eastern part of Blount county, from whence flowing southwestwardly, enters Jefferson, in which it joins the Mulberry Fork. Mulberry river rises in Walker and the western part of Blount county by numerous branches which unite in the latter, enters Jefferson, and unites with the Locust or eastern branch.

Below the union of its two main branches, the Tuscaloosa, now a navigable stream, continues the course of Locust river S.W. 40 miles, to about 10 miles below the town of Tuscaloosa. Here the stream inflects to S.S.W. 40 miles to its junction with Tombigbee at Demopolis, and between Greene and Marengo counties.

The valley of Tuscaloosa is a triangle of 150 miles base from the mouth to the sources of Locust river, perpendicular 70 miles, and area 5250 square miles, draining the counties of Walker, Blount, Jefferson, and part of Lafayette, Tuscaloosa, Greene, Marengo, and Perry; and lying between N. Lat. 32° 30′, and 34° 23′, and Lon. 9° 18′ and 11° W. from W.C. See Art. Tombigbee, p. 42, of this volume.

TUSCALOOSA, county of Alabama, bounded W. by Pickens, N.W. by Lafayette, N.E. by Jefferson, E. and S.E. by Bibb, S. by Perry, and S.W. by Greene. Greatest length from east to west, 54 miles, and the area being about 1400 square miles, the mean breadth must be 26 nearly. It extends in

Lat. from 32° 52′ to 33° 28′ N., and in Lon. from 10° 10′ to 11° 02′ W. from W.C.

The declivity of this very large and important county is to the southwestward, and in that direction the Tuscaloosa traverses it by a very circuitous channel, dividing it into two not very unequal sections. The northwestern part is also traversed by Sipsey river, flowing also to the southwestward. The southeastern border on Bibb, follows the dividing ridge between tributary fountains of Tuscaloosa and Sipsey rivers. The surface is rolling rather than abruptly hilly. Much of the soil excellent. Excluding the Creek territory east of Coosa river, Tuscaloosa county is not far from central, regarding the extremes either of north or south or of east and west.

Though a wilderness at the termination of the last war with Great Britain, this new county contained, in 1820, a population of 8229.

By the post-office list of 1831, Tuscaloosa, beside the capital of the same name, had offices at Buck's store, Carthage, and Halbert's.

Tuscaloosa, the seat of justice, and of the government of the state of Alabama, is situated on the left bank of Tuscaloosa river, and very near the centre of the county. According to a table published in the post-office list, 1831, this state capital is, by the nearest mail route, 994 miles from Philadelphia, and 560 from Charleston in South Carolina. By a calculation on Mercator's principles, it bears S. 56¾° W. from W.C.; distance 720¾ statute miles; the given post distance between those places is 858 miles. N. Lat. of Tuscaloosa 33° 12′, Lon. 10° 43′ W. from W.C. DARBY.

TUSCANY. The Grand Dutchy of Tuscany, the ancient *Etruria, Tuscia* or *Thuscia,*[*] is bounded on the west by the Mediterranean; on the north by the dutchies of Lucca and Modena; and on the east and south by the States of the Church. It is of an oblong shape; its superficial extent being 1098 square leagues, and as the population in 1826 amounted to 1,275,000, it averages 1,161 to the square league. It contains five provinces:

Provinces.	Population.
Florence	596,250
Pisa	295,640
Sienna	128,080
Arezzo	201,290
Grosseto	53,730
Total population	1,275,000

This Grand Dutchy contains no fewer than 26 towns, 135 burghs, and 6,017 villages. The chief towns are the following:

Towns.	Population.
Florence, the capital[†]	80,000
Leghorn or Livorno	66,000
Pisa	20,000
Sienna	18,000
Prato	10,000
Pistoia	9,000
Arezzo	7,000
Cortona	5,000
Volterra	4,000
Poutremoli	2,000
Grosseto	2,000
Piombino	1,500

The physical appearance of Tuscany is equally interesting and diversified. The Appenines traverse it in a south-east direction, but the highest summits of that range in Tuscany do not exceed 3,000 feet. Several smaller chains extend from this celebrated ridge in different directions, declining in elevation as they approach the sea. The champaign parts of the country consist chiefly of valleys extending along the banks of the numerous rivers with which the dutchy abounds. The rivers indeed, or rather streams, are so many, that they have been estimated at 200, all of which have their rise in the Appenines, or the mountains that diverge from them, and flow into the Mediterranean. The most important are the Arno, the Ombrone, and the Chiana. The valley of the Arno, it may here be mentioned, has been much celebrated. At a remote period, when Florence and Pisa were distinguished commercial cities, it was embellished with the villas of wealthy merchants. It is now inhabited by workmen, and in it are manufactured the linen stuffs that form an important article in the commerce of the grand dutchy, as well as those straw hats which, under the name of Leghorn hats, are known in every part of the world.

The climate of Tuscany may be regarded as on the whole agreeable and favourable, and characterized by that mildness, serenity and salubrity for which Italy has always been remarkable. But this description must not be taken in an unqualified sense. The sirocco or south-east wind, so prevalent in the south of Italy, rages to a most baleful extent in Tuscany, blasting the hopes and destroying the labours of the vine-dresser and the agriculturist. The district, known by the name of the Maremma, is probably the most unhealthful spot in Europe, and is as remarkable for its pestilential humidity as other parts of the same dutchy are for their fertility or beautifully diversified scenery. It stretches along the sea coast, from Pisa southward, and in superficial extent is equal to about 1,700 English square miles. It consists nearly of one continued marsh; it is comparatively destitute of inhabitants, the population being only forty persons to a square mile; and though means have already been used, and others are still contemplated, for draining and cultivating this unproductive district, it still remains as barren and as noxious as ever. The Maremma is chiefly devoted to pasturage.

Notwithstanding the general fertility of Tuscany, agriculture has not been brought to a very improved state. There is indeed no instance of a large farm, the country being subdivided into such small patches, that in some cases a pair of oxen is sufficient to perform the ploughing necessary in six or eight such lots. The most fertile portions of the dutchy are devoted to the cultivation of vines and olive trees; and almost all the corn fields also, are intersected by rows of these and other fruit trees. The peasantry are so poor, that even in the case of such patches, the landlord is obliged to supply part or the whole of the farming implements; a wretched system of farming, to which the name metayrie (the *coloni partiarii* of the Latins) has been applied. The Tuscans, however, display great ingenuity in irrigating their lands, and in extending cultivation along the declivities of their hills and mountains.

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[*] The ancient *Etruria* was in many places of greater extent than the modern Tuscany. The Tiber, for example, formed its boundary on the south.

[†] The ancient capital was *Cortona,* in the neighbourhood of the Thrasymen Lake, celebrated for the third defeat of the Romans by Hannibal. B. C. 217.

Some towns in Tuscany, particularly Florence and Pisa, were at one time remarkable for commercial enterprise. But circumstances are now changed. Leghorn is now the only port of any consequence. Its exports consist of wine, oil of olives, fruit of various kinds, perfumed essences, linen, woollens, Leghorn straw, manufactured silks of various sorts, marble: its imports are confined chiefly to articles from the north of Europe, and from the Levant, including tropical commodities.

The government is monarchical, not restrained by any representative body or any written authority, but exercised with mildness and judgment. The title of the sovereign is that of Arch-Duke; his appellation is Imperial Highness. The public revenue is £708,500; the public debt £5,000,000; the army does not exceed 4,000 men. The established religion is the Roman Catholic; the number of Jews amounts to 20,000.

Tuscany has been long celebrated for the learned men it has produced: in which respect it is probably superior to any other portion of Europe of equal population. It can boast of a long and illustrious list of statuaries, architects, painters, poets, authors historical, literary, scientific, theological. It can boast of the best collections of the fine arts, and the finest specimens of architecture in Europe. The celebrated picture gallery of the De Medicis is well known. Tuscany possesses three universities, those of Florence, Pisa, and Sienna. The number of public libraries is seven, one of them at Florence containing 130,000 volumes, including 11,000 MSS. Elementary schools are in a flourishing state; the Lancastrian mode of tuition has been introduced.

The history of Tuscany can be told in a few words. It long resisted the inroads of the Romans; and it was not conquered by that people till the year of the city 474, or less than three centuries before the christian era. After the fall of the Roman power, it was tributary to Lombardy. During the contention in the middle ages, Florence, Pisa, and Sienna erected themselves into separate commonwealths. The sovereign power of Florence, and afterwards that of the whole of Tuscany, came into the hands of the Medicis, an illustrious family that first acquired immense wealth by trade, and which, remarkable for literature and taste themselves, knew how to appreciate and reward these distinctions in others. This enlightened family, to whose patronage of the arts and of learning not only Tuscany but Europe are indebted, became extinct in 1737, when by arrangement between France and Austria, the archdutchy was conferred on the duke of Lorraine. Bonaparte deprived this latter family of their territory, which was erected into a monarchy under the name of the kingdom of Etruria, and given to the duke of Parma; it was afterwards declared an integral part of the French empire. But on the downfall of this ambitious conqueror, it was restored to the family who had succeeded the Medicis, and the island of Elba was added to it. (See Elba.) Ferdinand, a very enlightened prince, was in 1824 succeeded by his son Leopold II., now grand duke of Tuscany.

See the various *Travels* in Italy, particularly Simond's *Travels in Italy and Sicily;* Addison's *Remarks on Italy;* Eustace's *Classical Tour,* and Roscoe's *Life of Lorenzo de Medicis.*

TUSCARAWAS, river of the state of Ohio, the main and eastern constituent of Muskingum river, has its remote sources in Medina and Portage counties, interlocking sources with those of Cuyahoga and Mahoning branch of Big Beaver river.

The different higher branches uniting in the northwestern angle of Stark county, and by a course a little E. of S. passes the villages of Clinton, Massillon, and Bethlehem, in Stark, and Bolivar, Zoar, Canal-Dover, New Philadelphia, Schoenbrun, Gnadenhutten, and Newcomerstown, in Tuscarawas county, bends gradually in the southwestern part of the latter, to a course nearly due west, which it pursues to its junction with White Womans creek at Coshocton, in Coshocton county, to form the Muskingum river.

The entire comparative course of Tuscarawas is less than 80 miles, and only about 70 below the New Portage, where it is united to the Cuyahoga by the Ohio Canal. This important public work gives great interest to the physical history of Tuscarawas. The canal follows its valley either near or at no great distance from its banks, from the village of New Portage, in Medina county, to its mouth at Coshocton. The canal at the summit is 873 feet above the level of the Atlantic ocean, 305 feet above lake Erie, and 499 feet above the Ohio at Portsmouth.

TUSCARAWAS, county of Ohio, bounded south by Guernsey, southwest by Coshocton, northwest by Holmes, north by Stark, and east and southeast by Harrison. The extreme length, either north and south or east and west, is nearly equal to 30 miles; the mean breadth 24, and area 720 square miles; extending in latitude from 40° 13′ to 40° 39′, and in longitude from 4° 8′ to 4° 44′ west from W.C.

The general declivity is to the southward, in which direction the northern part is traversed by Tuscarawas river and "Ohio Canal." In the southern section of the county, both the natural and artificial channels wind to S.W. and W.

By the post list of 1831, there were post offices in Tuscarawas, beside at New Philadelphia, the seat of justice, at Bolivar, Cadwallader, Canal-Dover, Dohrman, Gnadenhutten, Leesville, New Comerstown, New Hagerstown, One Leg, Sandyville, Shanesville, Tuscarawas, and Zoar.

New Philadelphia, the seat of justice, stands on the left or eastern bank of Tuscarawas river, 50 miles, a little N. of W. from Steubenville, and by post road 314 miles N.W. by W. from W.C., and 107 N.E. by E. from Columbus. North Lat. 40° 31′. Lon. 4° 32′ W. from W.C. Darby.

TWEED. See Berwickshire, Peeblesshire, Roxburghshire, Selkirkshire, and Scotland.

TWIGGS, county of Georgia, bounded N. by Jones, N.E. and E. by Wilkinson, S.E. and S. by Pulaski, and by Ocmulgee river, separating it from Houston, S.W., and Bibb W. Length from S.E. to N.W. 26, mean breadth 16, and area 436 square miles; extending in Lat. from 32° 30′ to 32° 56′, and in Lon. from 6° 19′ to 6° 40′ W. from W.C.

Though bounded westward by Ocmulgee river, Twiggs county embraces part of the table land between that stream and Oconee river. The western and larger section declines to the southwestward towards Ocmulgee, whilst the eastern side has a southeastern declivity towards the Oconee. Much excellent soil exists in this county, with considerable extent, on the other hand, which is sterile.

Beside at Marion, the seat of justice, there were in 1831 three other post offices in Twiggs, namely, at Granberry's, Raisin's store, and Taruer's store.

Marion, the seat of justice, is situated near the centre of the county, by post road, 37 miles S.W. from Milledgeville. North Lat. 32° 42′. Lon. from W.C. 6° 30′ W.

By the census of 1820, Twiggs contained a population of 10,447, of whom 6968 were whites.

TYE, a small river of Virginia, gaining importance from forming for some part of its course the demarcation between Amherst and Nelson counties. It rises in the southeastern valleys of Blue Ridge, by several branches, which flowing generally to the southeastward, unite and fall into James river, about 25 miles, by the land route, below Lynchburg.

TYLER, county of Virginia, bounded N. by Ohio county of the same state; N.E. by Greene county of Pennsylvania, and Monongalia of Virginia; E., S.E. and S. by Harrison; S.W. by Wood and by Ohio river separating it from Washington county state of Ohio W. and Monroe county of Ohio N.W. Length from southwest to northeast 46 miles; main breadth 20 miles, and area 920 square miles. Extending in Lat. from 39° 14′ to 39° 42′ N. and in Lon. from 3° 26′ to 4° 12′ W. from W.C. The declivity of Tyler is to the westward towards Ohio river, which large stream opposite this county flows to the southwestward. It is drained by Middle Island and Fishing creeks. Surface very hilly, though much of the soil is highly productive.

Beside at Middlebourne, the county seat, there were in 1831, post offices at Fishing Creek, Grape Island, Ingham's Mills, Pine Grove, and Sistersville.

Middlebourne, the seat of justice, is situated on Middle Island creek, 41 miles N.W. by W. from Clarksburg, about 50 direct land course, a little W. of S. from Wheeling, and by post road 273 miles a little N. of W. from W.C. N. lat. 39° 30′. Darby.

TYNE. See England, Newcastle, and Northumberland.

TYNEMOUTH, a town of England, in Northumberland, situated at the mouth of the Tyne, about nine miles E.N.E. of Newcastle. It consists of several narrow, irregular, and dirty streets; the principal one of which runs along the river and round the harbour. The church is about a mile from the town. This place is celebrated for its ancient castle and priory, situated on a rock inaccessible from the sea. The walls were repaired in 1783, and made a depot for military stores. The principal remains of the ancient building is an old gallery, which has lately been flanked with bastions. Some handsome remains of the monastery, which were within the castle, still exist. The whole presents a fine group of picturesque views. The principal object is the church, at the east end of which is an elegant chapel.

The trade of Tynemouth is considerable, though the harbour has only seven feet of water at low water. A ridge of rocks, called the black middens, render it very dangerous, but a lighthouse directs the mariner in that dangerous navigation. The principal exports of the place are coals and salt, about 770,000 chaldrons of the former being annually sent to London. The imports consist of timber, iron, flax, and groceries. The harbour is defended by Clifford's fort, erected in 1672, but lately repaired and mounted with heavy guns. Extensive military barracks stand near it.

Tynemouth is much resorted to for sea-bathing. Commodious hot and cold baths have been erected, and good lodgings may be procured. Marsden rocks, separated from the coast by the gradual action of the sea, are an object of interest. At high water they are 50 or 60 yards from the land, though in the memory of man they could have been reached by a common plank.

The population of the township in 1821 was—houses 1525, families 2214, do. in trade 669, males 4192, females 5262, difference of male and female population 1070, total population 9454.

TYPES. See Printing.

TYPES, Method of Casting. The exact form of every type is cut out of well tempered steel, so as to form a steel punch, with a solid type at its extremity. This steel punch is used to convey a hollow impression from the type to a piece of brass or copper. This impression when well cleared of all roughness is the *matrix* of the type.

This *matrix* is placed at the bottom of a mould which is constructed with great ingenuity. The type metal, consisting of lead, with a due proportion of regulus of antimony, is then melted, and by means of an iron ladle, the workman pours a portion of it into the mould, which descends into the matrix and forms the type. By means of the mechanism of the mould, he is able to toss the type out on a piece of paper, and he proceeds to form other types in succession. This operation is managed with such dexterity that a workman can cast about 3000 of these letters in one day.

The types when sufficiently accumulated are taken away by boys, who break off the jets or little ingots of metal, while another set of boys take them from the first set and polish the broad side of the types upon smooth stones. Another set of boys arrange the types on long rules or dressing sticks. A clever workman then polishes all the sides of each column or row with a sharp but thick-edged razor. The types are next *bearded* or *barbed* by running a plane faced with steel along the shoulder of the body next to the face, which takes a greater or a less quantity off the corner of each type. The next operation is that of *grooving*, which is performed by a steel cutter which makes an uniform groove along the whole row of types.

When the types are thus dressed, the imperfect letters are picked out, and the whole are then put up into pages and papers ready for use.

TYRE, or Sour, a seaport town of Syria, occupying the site of ancient Tyre the "Queen of the sea." The walls of the city may still be traced in the form of an irregular square, nearly a mile in circumference. They are fast going to ruin, though sustained here and there with columns of granite. Two or three old rusty cannons are mounted upon them. On the west side the sand reaches nearly to the summit, but on the south and east they are thirty feet high. Remains of ancient niches are seen at the south-west and south-east corners. There is a wooden gate in the eastern side, and on the north a passage is made in the wall. The houses, amounting only to 200 inhabited ones, are well constructed from the ruins of the city; the ruins of a large church, built of hewn stone in the Syrian style, stands without the walls of the city; and to the south of it are very beautiful remains of buildings, which may have belonged to the archiepiscopal palace. The ruins of other churches are also visible. At the east end of the harbour, near the walls, are the remains of two Arab towers, one of which is 60, and the other 35 feet in height. They are conjectured to have been reservoirs belonging to the aqueduct. Pocock observed a thick wall stretching from the one to the other. The harbour itself, which extends 80 feet along the shore, and 150 along banks projecting into the sea, admits only boats.

The trade of the place consists chiefly in tobacco, of which 100 cantars (196 lbs. each) are sent to Cairo and Damietta, where it pays £20 to £25 per cantar. Charcoal, dried figs, and faggots of wood are exported to the same places. A large pottery and fishery are farmed for £115.

The inhabitants consist chiefly of Greeks and Catholics, with 12 Maronite families, but not a single Jew. East Lon. 35° 20′. North Lat. 33° 10′.

TYROL, which is formed of part of the ancient *Rhœtia*, and which is now a province belonging to the Austrian empire, derives its name from an ancient fort, (*Terioli*,) situated on a mountain near Meran, on the Adige. It is bounded on the north by Bavaria; on the west by Switzerland; on the south by the Lombardo-Venetian kingdom; and on the east by Illyria and the circle of Austria. The superficial extent has been estimated variously, but 7000 square miles may be regarded as not far from the truth; the population has been ascertained to be 762,653.

Tyrol is divided into seven circles; namely, the Upper Inn, the Lower Inn, Pusterthal, the Adige or Botzen, Trente, Roveredo, and Voralberg. There are 22 towns, of which Inspruck is the capital, 36 burghs, and 3150 villages. Inspruck, which signifies the Bridge of the Inn, is situated at the confluence of the Sill and Inn, with a beautiful bridge over the latter river. It is, on the whole, a mean town, though it is distinguished by some good buildings; and its population amounts only to 10,000. Roveredo, the capital of the circle of the same name, is a larger town than the metropolis, containing 13,000 inhabitants. Trente is well known on account of the last Roman Catholic council having been held there, which lasted from the year 1545 till 1563. Of Schwatz, the chief town of the Lower Inn, the population amounts to 7400, nearly one-third of whom find employment in the copper and silver mines in its neighbourhood. The other more important towns are Botzen, on the Bisach, a tributary of the Inn, population 8000; Ala, on the Adige, 6500; Hall, below Inspruck, 4200; Brixen, on the Bisach, 3800.

The physical appearance of Tyrol is similar to that of Switzerland. The chain of the Alps traverse it from west to east; the highest ridges are Ischernowand, Orteles, Glokner, and Mount Brenner, the first being 12,000 feet, the last nearly 6000. There are, besides, two secondary chains, one in the north, separating Tyrol from Bavaria, the other in the south, dividing it from Italy. Glaciers, of which some are several leagues in extent, and avalanches, dismal precipices, and lofty foaming cataracts, abound as much here as in the country to which we have compared it. Tyrol is exclusively mountainous, with the exception of the valleys which intervene between the different ridges; but these valleys are no fewer than about twenty in number; thus affording, in point of scenery, the most rapid transitions, and the most striking contrasts. The mountains, covered with eternal snow, send down innumerable streams, which add beauty to the respective valleys through which they flow. Two rivers form the recipients of all the lesser streams, the Inn on the north, the Adige on the south. The former, rising in the Grisons and flowing past Inspruck, loses itself in the Danube at Passau. The Adige takes its rise also in the Grisons, and after traversing Tyrol and the north of Italy, falls into the Gulf of Venice.

Of this country the climate is cold both summer and winter, except in the valleys, where heat abounds to a high degree. Except in the low grounds, agriculture has made little progress, though much labour and patience have been expended in extending it. The natives ascend apparently inaccessible heights, carrying manure in baskets, to gain a few feet of land, and devote it to agriculture. After all, however, they are obliged to import corn. The bowels of the earth are more productive; every species of ore, from gold to coal, being found there; but comparatively few of them are wrought. Mineral springs are common. The salt mines are the continuation of those in Satsburg, and one of them near Hall yields 25,000 quintals. Vineyards are numerous, particularly in the valley of the Adige: the natives cultivate fruit trees; and from the forest, they rear silk worms, and export raw silk. The transit trade between Italy and Germany forms a most extensive and lucrative branch of commerce.

They are a singularly industrious people. They cannot be said to possess any manufactories; but every Tyrolean is a manufacturer. There is little division of labour. A family or an individual is obliged to do every thing for himself, else his few wants could not easily be supplied. And recourse is had to the most ingenious modes of fabricating the articles of which they stand in need. "Do they require flour, or stand in need of oil? As every individual provides in some respects for his own wants, there are neither millers nor oil mills; but at the neighbouring stream the corn is ground, and the oleaginous plants are pressed. A German traveller observes that, to abridge labour, he has seen a child rocked in its cradle by means of a wheel made to revolve by a stream." (*Malte-Brun*, vii. 515.)

The people have a thirst for independence; and if they cannot find employment at home, they do not hesitate to emigrate to other countries to gain a livelihood. Bavaria or the neighbouring provinces, which is their earliest outlet, do not satisfy them. They emigrate to the most distant countries, to England, America, or the East Indies, generally as pedlars, selling petty wares. Thirty thousand are calculated to leave their native land annually. They return, however, in old age, having amassed a little stock, to enable them to spend the evening of their days in comparative independence. The music of the Tyrolese has been long celebrated for its simple and plaintive character. In other respects, they are distinguished by the characteristics common in their circumstances; loyalty, love of country, bravery, frankness, hospitality, uncorrupted morals, superstition, religion. They are all Roman Catholics, with the exception of eight or ten Jewish families. Their language is German. Tyrol cannot boast of a university, but there are various Lyceums, Gymnasia, and other seminaries, where every branch of education is taught. The number of such seminaries, including elementary schools, is no fewer than 819.

The history of Tyrol may be comprised in a few sentences. The *Rhaeti*, the ancient inhabitants, to whom Horace applied the epithet *immanes*, (lib. iv. 14.) and who had made formidable encroachments on the Romans, were first subjected to that people by Drusus, brother to the emperor Tiberius. From that period their country composed an integral part of the Roman empire. On the inroads of the Goths and Vandals, it shared the fate of the rest of Europe, and fell into the hands of these ruthless barbarians. After several changes, it became subject to Austria about the beginning of the 14th century: in whose hands, with the little interruption which we are about to mention, it has since continued. This interruption refers to its being ceded to Bavaria by the treaty between the French and Austrians signed at Presburgh, (26th Dec. 1805,) after the power of Austria had been paralized by the disaster at Ulm and the defeat at Austerlitz. Bavaria treated her newly acquired territory in a most arbitrary manner. Not only did she exert herself to strip Tyrol of the privileges she had enjoyed under Austria, but suppressed the very name of the country, and interfered with the sacred rights of the church. The Tyrolese were too brave and proud a people, and held liberty in too high veneration, long to submit to such indignities. The flame of insurrection spread throughout the province in 1809; and it was fanned and cherished by an individual whose great energies the crisis called forth,—the William Tell of his country,—Andrew Hofer, a person of humble origin, but whose name now ranks with that of the first patriots and heroes. He performed prodigies of valour, and was ably supported by his suffering countrymen. But fate had doomed these noble exertions to be unsuccessful. Austria could render no assistance; the French and Bavarian forces poured into Tyrol; and after Hofer, like our Scottish Hero, had thrice rescued his country from the hands of the enemy, he was, like him too, betrayed into their hands; and he submitted (1810), with fortitude to a public death. Tyrol, meanwhile, continued in the possession of the Bavarians till 1815, when, by the congress of Vienna, it was restored to Austria, and reinstated in all its ancient privileges. These privileges are not unimportant. It has, for example, a representative body, consisting of four orders, the clergy, the nobles, the deputies respectively of the towns and the peasants. Without the consent of this body no tax can be imposed. Tyrol is the only country subject to Austria, where the peasantry are adequately represented. The revenue which this country yields, we may mention in conclusion, amounts to 2½ millions of florins, though there are no custom-houses on the frontiers. This sum is obtained from a land-tax, and from duties which affect only the higher classes. The military force is confined to four battalions of light armed troops, but in cases of emergency, the Tyrolese are willing to rise to a man to defend their country.

See the article AUSTRIA; Beaumont's *Travels through the Rhaetian Alps in the year* 1786; *Voyage dans le Tyrol*, by M. de Bray; Kotzebue's *Travels in Italy through the Tyrol; The Life of Hofer*, translated from the German by Hall; and *The Annual Register for* 1810 *and* 1815. (&)

TYRONE, a county of Ireland in the province of Ulster, is bounded by Londonderry on the N. by Armagh on the E. by Monaghan and Fermanagh on the S. and by Donegal on the W. It is about 42 miles long from N. to S. about $54\frac{1}{2}$ from E. to W. and contains 1271 square miles, or 813,440 English acres. Its political divisions are the baronies of Dungannon, Strabane, Omagh and Clogher, and it contains 35 parishes in the sees of Derry, Armagh, and Clogher.

The northern part of the country is rough and mountainous. The Cairntogher and Munterlony hills occupy an extensive tract, and to the south in the barony of Strabane are two lofty hills called Bessy Bell and Mary Gray.

The rivers in Tyrone are numerous. The Mourne, which is the principal one, passes through the centre of the country from north to south. It rises in the mountains near Clogher; at Omagh it is joined by the Cameron from the south, and a little farther on by the Po from the west. After receiving at Newton Stewart the Moyle, &c. and at Ardstraw the Derg, it runs to Strabane, below which it meets the Fin, with which it proceeds under the name of the Foyle to the sea. It is navigable for large boats. The Blackwater is also navigable for ten miles. The Ballinderry passes by Cookstoun and flows into Lough Neagh.

Agriculture is in a very low state in this county, owing to the unprofitable manner in which the farms are occupied. The land is held in what is called *Rundale*, the arable land being divided into a certain number of shares, which are changed annually, the cattle of the different tenants pasturing in common. The arable land is wrought more with the spade than the plough, and when a plough is used, it is drawn by horses, bullocks, and even milk cows, contributed by three or four neighbours, each of whom attend the operation for the behoof of his cattle. The chief crops are potatoes, oats, and flax. The cattle and sheep are of a very inferior description. The best land is in the barony of Dungannon, and there is also a considerable portion of good land in Clogher.

There is little or no limestone in the county. Clay fit for bricks and pottery is abundant, and the barony of Dungannon is said to produce the best pottery in Ireland, consisting of crockery ware, fire-bricks, and tiles. At Coal Island, situated in the eastern part of the county, five coal pits were working in 1800, but Mr. Wakefield describes the coal as bituminous and of a bad quality. Mr. Griffith has also expressed an unfavourable opinion of the extent and value of the coals of Tyrone.

The principal proprietors of Tyrone are the marquess of Abercorn, lords Belmore, Northland, and Mountjoy. Many of the estates are worth from £5000 to £7000 per annum. The village farms do not exceed twenty acres each, and the leases are for thirty-one years and three lives—three lives—and twenty-one years and a life.

The chief towns are Omagh the county town, Newton Stewart, Augher, Clogher, Strabane, and the burgh of Dungannon. Strabane is a thriving town, situated on the Mourne, and has a good market for many articles, particularly linen cloth. The canal which connects it with the Foyle is a principal source of its prosperity. It was represented in parliament before the union. Dungannon has a good linen market, and from the collieries at Drumglass, in its vicinity, there is a canal to the Blackwater. It has a barrack for a troop of horse. Newton Stewart is a neat small town, agreeably situated on the river Foyle. Augher and Clogher, though parliamentary burghs before the union, are very small places. The linen manufacture is carried on to a great extent in the county.

The county sends two members to parliament, and the borough of Dungannon a third.

In 1771 the population was 157,700. In 1821 it was 259,691. The catholics are to the protestants as six to one, but the property chiefly belongs to the latter. See M'Evoy's *Statistical Survey of Tyrone and Ireland*, and Wakefield's *Statistical Account of Ireland*, passim.

TYRREL, county of North Carolina, bounded by Hyde county S., Washington W., Albemarle Sound N.; and including the islands along the coast, by the Atlantic Ocean E. Greatest length from east to west, including the islands and intervening sound, 52 miles; mean width 18 miles. The actual land area, however, not exceeding 800 square miles. Extending in Lat. from 35° 36′ to 35° 56′ N., and in Lon. from 0° 36′ to 1° 40′, including the Roanoke islands.

Surface flat and in great part marshy. The continental part indented by Alligator river or bay, making to the southward from Albemarle Sound. It is in fact the recipient of the water from extensive swamps between Albemarle and Pamtico sounds.

The only post office in the county is at the seat of justice, Columbia, situated on a small bay near the northwestern angle of the county, by post road 170 miles a very little N. of E. from Raleigh. N. Lat. 35° 53′, Lon. 0° 43′ E. from W.C.

In 1820 the population of this county was 4319, of whom 3007 were whites. DARBY.

TYRTÆUS, a Greek poet, and a native of Attica. He is said to have exercised at Athens the functions of a schoolmaster, a poet, and a musician. In the recent Messenian war, the Lacedemonians, having been unsuccessful, were directed (B.C. 623) by the oracle at Delphi to apply to the Athenians for a general, in order to secure success. The Athenians sent them, in derision, the poet Tyrtæus, remarkable for his deformity and his ignorance of military affairs. Tyrtæus, however, recited songs in praise of valour and patriotism, and when the Lacedemonians were about to raise the siege of Ithome, he excited them to such a paroxysm of courage, that they defeated the Messenians, and reduced them to subjection. For this and other services, the Spartans honoured him with the right of citizenship. Horace has united his name with that of Homer, and, from the fragments of four or five war elegies which are extant, there can be no hesitation in ranking him among the greatest of the Greek poets. He composed also a treatise called "Moral Precepts," and a work on the "Polity of the Lacedemonians."

U. V.

VACCINATION. See Inoculation, Vol. XI. p. 310—316.

VACUUM. See Pneumatics.

VAILLANT, Sebastian. See Botany, Vol. IV.

VALAIS. See Switzerland, Vol. XVII.

VALENCIA, Province of. See Spain.

VALENCIA, probably the *Valencia Edetanorum* of the Romans, is the capital of the above province. It stands about two miles from the sea, in a plain on the Guadalaviar. It consists of narrow and crooked streets, intersected by countless lanes. The public buildings are El Real, the ancient palace, the Gothic cathedral, a Moorish mosque, the college of Pio Quinto, the Carmelite convent, the college of the patriarchs, the custom house, and the lodge for the commercial court. There are here two public libraries, a university, and an academy of painting. The chief manufacture is silk, besides woollen and cotton goods, lace and cordage. Population about 80,000, besides about 16,000 in the adjacent villages. West Lon. 0° 23′ 3″, North Lat. 39° 28′ 45″. See Laborde's *View of Spain.*

VALETTA, La, the capital of Malta. It consists of five separate quarters.

	Population.
1. Citta Nuova,	23,000
2. Barmola,	
3. Cottonera,	
4. Citta Vittoriosa,	4,000
5. Senylea,	4,500
Total population,	31,500

This city enjoys the finest situation that can be desired. The streets are regular and well paved with lava, and the quays and public squares contain many large and elegant buildings. The churches, with the cathedral, amount to 21. The other public buildings are, the residence of the Grand Master, the Castellanea, containing the courts of justice, the town house, the arsenal, and the ancient palace of the inquisition. There are here two libraries; one, that of the knights, containing 40,000 volumes, the other a subscription one; the Jesuits' college, containing an exchange and a small theatre; the hospital of St. John, a foundling hospital, an orphans' hospital, and the maddalena.

On the south side of Citta Nueva is a beautiful bay, in which the largest vessels can at all times ride in safety: it is subdivided into five distinct harbours, the entrance being scarcely a quarter of a mile in breadth, and defended by a battery of four tiers of guns. The fortifications of La Valetta possess an extraordinary degree of strength. The town carries on a considerable trade, and, as a naval station, it is invaluable to Great Britain. See Malta.

VALDIVIA. See Chili, Vol. VI. p. 32.

VALPARAISO. See Chili, Vol. VI. p. 33.

VANBRUGH, Sir John, a celebrated dramatist and architect. His first play, called "the Relapse," was acted in 1697, and in the following year he brought out his "Provoked Wife" and his "Æsop." In 1702 appeared his "False Friend," and in 1705 "the Confederacy." He was knighted and made Clarencieux King at Arms in 1702, and he subsequently distinguished himself as an architect. A full account of his architectural works will be found in our article Civil Architecture. He died at his house at Whitehall in 1726.

VANDEVELDE. See Painting, Vol. XV.

VANDIEMEN'S Land. See Australasia.

VANDYKE, Sir Anthony, was born at Antwerp in 1599, and died on the 9th Oct. 1641, in the 42d year of his age. See Painting, Vol. XV.

VAPORISATION. See Evaporation, Hygrometry, Meteorology, Physical Geography, &c.

VARIATION, Calculus of, is a branch of modern analysis, invented by Lagrange. We have already given an account of its principles in the able articles on Isoperimetrical Problems, written by J. F. W. Herschel, Esq., and we had proposed to enter into a more detailed account of its principles, under the present article, but the limits prescribed to the work will not allow us to resume the subject.

VARIATION OF THE NEEDLE.

In our article Magnetism, we referred to this place for an account of the magnetical phenomena of our globe, and we shall now endeavour, so far as our narrow limits will permit, to give an account of the interesting discoveries which have been recently made in this important branch of science.

The general principles of the *variation* and *dip*, or the *declination* and *inclination* of the needle, have been explained in the article above referred to, so that we shall at once proceed to consider how these two classes of phenomena are related to the equator and poles of the terrestrial globe. The measures of the variation and dip of the needle have been obtained principally by navigators and travellers, at different times, and by means of instruments of various degrees of accuracy. From this cause, it is impossible to place great confidence in the accuracy of the results; and it is only from the general bearing of the observations that we can deduce any thing like a general principle. The following table contains the best measures of the variation of the needle.

I.—*Containing the Variation of the Needle, as observed in Denmark, Norway and Sweden.*

s of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
	1796	20°21'W.	Kongsör	1746	9°30'W.
	1799	17 25	Kusamo Church	1776	5 30
	1799	17 40	Lindesness	1605	7 10 E.
	1768	19 20	Lofoeden Isles	1608	0 0
	1791	24 45		1609	0 0
	1792	25 30	Lund Pfarrhof	1785	19 30 W.
Island	1792	24 52	Lyderhorn	1768	19 20
d	1780	34 30	Lindesberg	1746	9 36
sund	1768	16 30	North Cape	1769	6 0
sand	1794	22 0	Nora	1799	18 35
ia	1761	15 15	Norrberke	1799	17 35
	1769	16 45	Orebroe	1799	17 7
	1816	20 15	Patrixfiord	1772	33 30
	1817	20 3	Rust Island	1613	4 8 E.
	1799	17 5	Stavanger	1794	22 26 W.
a	1716	11 15	Skudesness	1613	8 0 E.
gen	1649	1 30 E.	Stadthuk	1768	19 10 W.
	1672	3 35 W.		1790	25 45
	1730	10 37	Stockholm	1718	5 37
	1770	15 32		1771	13 4
	1782	17 41		1800	16 20
	1806	18 25		1817	15 34
	1817	18 5	Salberg	1746	9 0
	1817	17 55½	Sala	1799	16 0
m	1761	13 50	Söderbärke	1746	9 15
	1786	19 0	Sälö Bak	1804	18 30
ds Haven	1786	42 41	Sädankyla	1776	5 30
	1799	18 45	Skiervoens Church	1768	16 30
be	1783	19 29	Strömstad	1804	18 0
ksborg	1810	18 50	Sulen Island	1791	27 15
rg	1694	8 30	Talvig	1766	6 50
	1748	12 40	Tornea	1695	7 0
rd	1786	35 21		1736	5 5
havn	1786	43 9		1767	8 50
fest	1765	6 50		1777	11 45
en Island	1766	7 0	Utsjoki	1748	3 30
Church	1768	16 25	Upsal	1718	5 37
land	1672	2 35		1746	8 45
er	1761	14 0	Uhma Capel	1762	10 45
a	1748	9 10	Uranienburg	1672	2 35
wi	1776	11 30	Wardhus	1748	0 0
Church	1766	5 30			0 30
	1768	6 50		1775	5 32
nger	1779	17 30	Vadsöe	1816	7 55
	1803	21 0	Vangs Church	1793	19 50
	1799	17 15	Vesteräs	1799	17 50
parberget	1799	17 25	Vinga Bäk	1804	19 0

E II.—*Containing the Variation of the Needle in Russia.*

s of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
a Bay	1805	5°39'E.	Irkutsk	1735	1°15'W.
i Kamen	1787	17 40		1805	0 32 E.
	1770	2 45	Jarowslawl	1782	4 0 W.
	1761	2 25 W.	Jenicola	1785	7 15
	1805	2 2 E.	Kola	1769	1 45
enburg	1761	0 50	Krementschuk	1770	8 0
	1805	5 27	Krasnojarsk	1735	2 0
	1783	7 27 W.	Kiachta	1735	3 0
	1811	5 17		1735	2 45
	1782	10 10	Kiow	1773	9 15
	1772	7 0	Kaluga	1784	7 45
sk	1771	5 49	Kursk	1784	5 0
	1773	6 30	Kostroma	1782	3 45
	1773	10 40	Kesloff or Kozlov	1785	11 38
bet	1770	9 45			
	1770	5 30	Lubny	1782	9 5
	1769	3 35	Moscow	1732	5 26
ca	1615	18 0	Mosdok	1785	6 40
i	1768	5 15	Nezshni Kovima	1787	14 40 E.
	1769	5 0	Nizni-Udinsk	1735	3 15 W.
	1788	2 0		1805	2 40 E.

Table II.—*Continued.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
Nertchinsk	1735	3° 0'W.	Sietscha	1770	9°15'W.
Neschin	1779	10 0	Sisran	1770	5 50
	1782	10 0	Selenginsk	1735	0 30
Orenburg	1769	3 30	Saratow	1773	3 28
		3 20	Sewastropol	1785	11 13
Orsk	1769	0 15	Tscherkask	1770	5 50
Orel	1781	9 0	Tara	1805	6 6 E.
Petersburg	1726	3 15	Tomsk	1805	5 37
	1782	7 30	Tobolsk	1716	0 0
	1812	7 16		1761	3 46
Perm	1805	1 10 E.		1805	7 9
Petropaulowska	1779	6 19	Tanbow	1784	5 45 W.
	1805	5 20	Umba	1769	3 30
Petrosawodsk	1785	5 9 W.	Ufa	1769	1 30 E.
Ponoi	1769	1 10 E.	Ustkamenogorskoi	1770	2 0
Peczora	1611	22 30 W.			
Pustozerskoi	1614	20 0	Wologda	1785	3 52 W.
Revel	1751	7 30	Woronetz	1783	8 0
Riga	1750	8 0	Zarizin.	1770	4 50
Samara	1770	8 10			

Table III.—*Containing the Variation of the Needle in Holland, Prussic, the Netherlands, and Switzerland.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
Antwerp	1600	9° 0'E.	Konigsberg	1628	1° 0'W.
Amsterdam	1767	17 30 W.		1642	1 5
Augsburg	1772	16 40		1774	13 30
	1798	18 26	Leipsic	1749	12 0
Berlin	1717	10 42	Manheim	1776	19 48
	1780	16 48		1785	19 44
	1805	18 2		1786	19 53
Bonne	1782	17 20		1787	20 2
	1788	18 55		1788	20 5
Dantzig	1628	1 0	Mittau	1783	10 52
	1760	11 0	Middleburg	1786	21 14
	1811	13 48		1788	21 56
Dusseldorf	1783	20 0	Nuremberg	1685	5 5
Dresden	1797	18 30	Prague	1774	15 45
Freyberg	1769	15 40		1787	17 20
Frankfort-on-Mayne	1774	16 32	Rotterdam	1767	19 0
			Regensburg	1784	17 49
Franeker	1771	19 30		1786	19 11
	1773	18 30	Tübingen	1747	13 34
Geneva	1797	19 40		1752	14 37
	1804	21 13	Tankermund	1814	19 0
Grätz	1770	15 50	Vienna	1638	0 0
Göttingen	1777	16 48		1760	13 0
Hague	1782	20 16	Wurtzburg	1781	18 40
Inspruck	1787	22 40		1787	18 35
Konigsberg	1600	0 0	Zurich	1762	15 15

Table IV.—*Containing the Variation of the Needle as observed in France.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
Antibes	1682	3°40'W.	Montpellier	1674	1°10'W.
Bayonne	1680	1 20	Ushant Island	1776	23 1
Boulogne	1767	17 26	Paris	1541	7 0 E.
Brest	1679	1 45		1580	11 30
	1771	20 10		1660	1 0
	1798	25 30		1667	0 15 W.
Calais	1681	4 30		1700	7 40
	1767	19 30		1750	17 15
Dieppe	1619	6 30 E.		1780	20 35
Dunkirk	1767	18 33 W.		1800	22 12
Havre de Grace	1767	19 15		1819	22 29
	1782	22 15	Royan	1680	1 20
Marseilles	1761	18 0	Toulon	1682	2 45
	1698	20 55	Toulouse	1747	15 10
St Maloes	1681	2 0		1756	15 45

Table V.—*Containing the Variation of the Needle, as observed in Great Britain and Ireland.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
Bristol	1666	1° 27′ W.	London	1790	23 39′ W.
	1667	1 33		1800	24 3.6
Bushy Heath	1813	24 22 17		1823	24 9 40
	1822	24 35 26	Plymouth	unkno.	13 24 E.
Dublin	1745	18 0 W.		1733	13 27 W.
	1791	27 23	Stromness Harbour	1774	24 0
London	1580	11 15 E.			
	1657	0 0 W			

Table VI.—*Containing the Variation of the Needle, as observed in Portugal, Spain, and Italy.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
Aranjuez	1798	19 25′ W.	Lisbon	1638	7° 39′ E.
Alborne Island	1733	14 12		1668	0 50 W.
Braga	1761	16 15		1697	4 18
Brescia	1676	4 0 E.		1782	19 51
Cadiz	1724	5 25 W.	Loretto	1756	15 35
	1769	17 15	Madrid	1799	19 59
	1791	21 56	Malta	1694	9 15
Cape St. Vincent	1733	13 49			9 45
Cape St. Gatt, Sp.	1733	13 56		1708	10 25
C. St. Mary's, P.	1734	14 20	Minorca C. Mola.	1733	14 34
Cape Finisterre	1589	7 40 E.	Padua	1725	13 0
	1768	21 4 W.		1730	
C. St. Antonio, S.	1792	19 23		1770	16 20
Ferrara.	1677	2 0	Rome	1670	2 15
Gibraltar Bay	1733	13 38		1730	11 0
	1761	17 11		1788	17 12
	1792	22 6			

Table VII.—*Containing the Variation of the Needle, as observed in Turkey in Europe.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
Akiermann	1771	9° 25′ W.	Constantinople	1694	9° 0′
Bender	1772	9 45			12 0
Bucharest	1772	11 36	Ofen	1781	16 45
Constantinople	1600	0 0		1788	16 36
	1625	2 0			

Table VIII.—*Containing the Variation of the Needle, as observed in Asia and the adjacent Islands.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Magnetic Variation.
Alexandretta, Syria	1694	14° 22′ W.	Bombay, India	1676	12° 0′ W.
Aden, Arabia	1612	13 40		1721	5 12
	1612	12 40		1721	5 16
	1674	15 0		1722	5 7
	1723	13 50		1723	5 10
	1723	13 42	Banca Island	1791	0 0
Ava, India	1689	5 0	Balasore, India	1680	8 20
Aleppo, Syria	1781	12 30	Do. Cape Palmiras	1722	3 33
Alguarda near Goa	1722	5 49	Calicut	1722	4 5
Anjanga, India	1724	4 17		1772	4 9
Bab-el-Mandeb	1723	14 20	Canton	1690	2 25
	1723	14 8		1722	1 30
Baixos de Chagos Island	1610	19 50	Carwar Bay, India	1722	5 40
Beit-el-Fakih	1762	11 50		1722	5 4
Bachian Island, Amasane Bay	1612	4 48 E.		1723	5 8
				1724	5 32
			Celebes, Bonthain	1767	1 16

Table VIII.—*Continued.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	M Va
Chaul, India	1721	5° 27′ W.	Mangalore, India	1722	5°
Cape Comorin, India	1601	16 0		1722	5
	1620	14 20		1723	5
	1680	8 45	Masulipatam, India	1610	12
	1688	7 30	Machian Island near Gilolo	1612	4
	1723	2 51		1613	3
Ceylon			Maldevische Canal	1605	17
Friar's Hood	1722	2 12		1722	4
	1722	2 21	Mazeira Island, Arabia	1613	20
Point de Galle	1613	13 24	Mocha, Arabia	1723	13
	1723	2 46		1769	12
	1723	2 45		1776	11
Chandernagore India	1731	3 0	Mindanao, Cape St. Augustin,	1767	1
	1750	0 0	Nankin, China	1685	0
Cochin, India	1614	15 0	Nicobar, India	1605	7
	1724	4 16	Paliacate, India	1611	13
Daman, India	1612	16 30		1613	13
Dabul, India	1610	15 34	Patapilli, India	1611	12
	1611	16 30		1611	12
Derbent, Persia	1712	12 0		1613	13
Darsina, Arabia	1612	15 2	Pondicherry	1689	7
Doy or Doa Molucca Islands	1613	5 20 E.	Princes Island, near Java	1767	1
Firando, an island near Japan	1613	2 50		1780	0
Goa, India	1609	16 0 W.	Pulo Condore Island	1620	1
	1724	5 41		1780	0
Guadal Cape, Persia	1613	17 15	Pekin	1755	2
	1616	18 0	St. Paul's Island	1677	23
Hainan Is. China	1613	0 50	Roquepiz Island	1610	23
Hyderabad,* 27th June	1804	1 16.39E	Rogipore (Rajapur)	1722	4
Java: Bantam	1609	3 0 W.	Rasalgat Cape, Arabia	1613	19
Batavia	1767	1 25	Sually	1610	16
	1768	0 25		1611	16
Palimbang	1605	3 20		1612	17
Ispahan, Persia	1787	7 30	Sunda Strait	1615	3
Iriseh	1797	8 14	Sinde	1613	16
Ingana Island	1607	4 13	Sinope	1797	10
Jask Cape, Persia	1616	19 20	Surat	1611	16
Judda, Arabia	1769	11 52		1723	5
	1776	12 55	Singanfu, China	1689	3
Kasbin, Persia	1787	7 33	Sumatra,		
Kerguelen's Land	1776	27 44	Achen	1610	6
Louveau, Siam	1685	4 45	Marlborough Fort	1794	1
	1685	0 30?	Priaman	1795	1
	1686	4 45		1612	4
	1688	4 30		1613	4
Lucepara Island	1767	0 0	Tellichery, India	1722	4
Macao	1616	1 30		1722	4
	1779	0 32	Tiiz	1613	18
Madras, India	1722	2 52	Tecu Island	1612	4
	1723	3 16	Xin-Yam, China	1682	0
Madura Island, near Java	1768	0 30	Ula, China	1682	1

Table IX.—*Containing the Variation of the Needle, as ob in Africa and the adjacent Islands.*

Names of Places.	Year of Obser-vation.	Magnetic Variation.	Names of Places.	Year of Obser-vation.	Ma Vari
Alexandria, Egypt	1638	5° 45′ W.	Accara, Fort Guinea	1726	11°
	1798	13 6		1726	11
Ascension Island	1678	1 0 E.	Angoxa	1611	12
	1754	8 6 W.	Ab-dal-Curia Island, west of Sowtora	1612	17
	1775	10 52		1723	12
	1806	15 40			

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* This is the mean of two observations made at the Camp near Hussain Sangor, by Lieut. Col. Morison, and communicated to me by John Robison, Esq.

Table IX.—*Continued.*

s of Places.	Year of Observation.	Magnetic Variation.
s, Barbary	1731	14° 0′ W.
s Islands		
l Bay	1589	3 5 E.
	1775	22 7 W.
es	1600	0 0
e	1610	1 40
-Man-	1723	14 20
	1723	14 8
de Chagos	1610	19 50
on, Isle of, carenhas	1614	22 48
aul's ay	1722	19 49
	1722	19 44
m	1616	13 12
Coast	1726	11 55
	1726	12 10
	1726	11 46
y Islands		
o	1724	5 0
	1769	17 30
	1802	19 55
zarote	1610	6 6 E.
eira unchal	1727	6 58 W.
	1766	14 10
	1766	16 0
	1771	18 0
	1783	18 22
	1802	20 21
d Canary	1610	6 6 E.
eriffe, a Cruz	1769	15 43 W.
	1770	15 30
	1776	14 41
	1776	15 55
	1785	15 52
	1788	20 1
	1792	16 32
	1803	16 1
a Islands		
a, on t of Africa	1611	13 0
	1721	19 12
	1721	19 44
	1721	20 33
ouan	1722	20 39
	1722	20 33
otta	1722	21 12
	1722	20 24
lio, Verd Isl.	1611	15 20
o Praya, . Jago,	1725	4 5
	1766	8 20
	1766	8 20
	1772	10 45
	1791	14 12
o	1725	3 32
	1776	9 32½
	1610	3 30 E.
o	1694	12 15 W.
	1761	12 25
	1762	11 40
	1798	12 0
tta, Egypt	1694	12 30
Ajan	1611	17 36
	1611	17 20
ce Edd's Island	1776	26 15

Names of Places.	Year of Observation.	Magnetic Variation.
France, Isle of, (Mauritius)	1609	21° 0′ W.
	1722	18 46
	—	18 39
	—	19 7
	—	19 45
Cape of Good Hope		
Cape l'Aguillas	1609	0 12
Saldanha Bay	1605	0 30 E.
	1614	1 30 W.
Simon's Bay	1780	22 16
	1791	23 40
Table Bay	1614	1 45
	1667	7 15
	1675	8 28
	1687	8 30
	1699	11 0
	1702	12 50
	1706	13 40
	1708	14 0
	1721	16 25
	1724	16 27
	1724	16 18
Gorée	1682	0 0
	1769	12 15
	1772	10 30
Guardafui Cape	1610	17 35
	1723	12 34
Hermanas Island, near C. Guardafui	1612	17 23
St. Helena, Island of,	1600	8 0 E.
	1691	1 0 W.
	1806	17 18
Madagascar		
Augustin's Bay	1607	15 30
	1721	23 48
Antongill Bay	1661	22 30
	1761	18 0
Fort Dauphin	1661	19 0
	1761	22 7½
Foul Point	1762	16 45
St. Sebastian Cape	1600	16 0
	1722	18 36
St. Mary's Island, near Madagascar	1610	19 50
	1722	19 53
Nosf-Gombi, an island near Madagascar	1722	20 0
Salée Roads	1735	12 19
Sierra Leone	1608	1 30 E.
	1725	5 12 W.
Sunken Rocks, S. Lat. 31° 48′	1606	21 0
Socotra, Island of	1611	16 0
	1776	8 6
St. Thomas, Isle of	1726	14 48
	1726	14 32
Tripoli	1733	13 22
Trinidad, Island, S. Lat. 20° 45′ N. Long. 29° 30′	1615	12 0 E.

Table X.—*Containing the Variation of the Needle, as observed in America and the Adjacent Islands.*

Names of Places.	Year of Observation.	Magnetic Variation.
Acapulco	1744	8° 0′ E.
Albany Fort	1730	23 0 W.
Antigua Island	1774	17 0 W.
	1727	4 28 E.
	1761	4 31 W.
Augustin Cape	1670	5 30 E.
Bear Island	1596	13 0
	1610	13 30
Beverley	1781	7 4 W.
Barbadoes, Carlisle Bay	1726	4 24 E.
	1761	3 47
Bastimento's Isle	1726	7 48
Boston	1708	9 0 W.
	1741	7 30
Button Isle	1615	24 0
	1730	39 0
Buenos Ayres	1708	15 32 E.
Bahia, Brasil	1708	4 30
Cambridge	1708	9 0 W.
	1783	6 52
Cape Cathivas	1726	7 24 E.
Carthagena	1705	7 12
	1726	6 50
St. Croix Island	1783	3 20
St. Christopher's Basseterre	1726	4 10
Cuba		
Pau de Matanzas	1726	4 24
Havannah	1732	4 30
Cayenne Island	1672	11 0
	1682	5 30
Conception	1709	10 20
Coquimbo	1700	8 32
Curaçoa	1704	6 40
Cumana	1799	4 14
Chesapeake Bay	1732	4 58 W.
Cod Bay	1789	6 45
Cape Christian, Greenland	1605	12 15
St. Catharine's Island	1712	12 0 E.
	1785	12 0
	1804	7 51
Cape Corientes	1684	4 28
Discovery Harbour	1792	21 30
Desolation Sound	1792	19 16
St. Diego California	1792	11 0
Deseado Island	1726	3 27
Domingo		
Cape François	1772	5 20
	1776	5 30
	1783	5 32
Alta Vela Island	1728	6 2
Frio, Cape	1670	12 10
Fernando Naronha	1610	8 10
Florida, Cape	1726	3 26
Fuego, Terra del		
Christmas Sound	1774	24 43
Good Success Bay	1769	24 9
Godthaab, Greenland	1784	50 30 W.
	1787	51 21
Guadaloupe	1726	3 22 E.
Hermit Island	1707	20 0

Names of Places.	Year of Observation.	Magnetic Variation.
Juan Fernandez	1767	11° 0′ E.
Jamaica		
Portland Point	1726	6 2
Port Royal	1726	4 31
Black River	1732	6 2
Jamba Point	1726	6 20
Lima	1709	6 15
Mexico	1769	5 30
Martinique	1682	4 10
	1704	6 10
	1760	5 41
Marie Galante Island	1726	3 40
St. Martha, Cape	1704	7 6
Massafuera Island	1765	9 36
	1767	10 24
	1795	9 15
Mendocino, Cape	1693	2 0
	1786	14 24
Moose Fort, Hudson's Bay	1774	17 0 W.
Musquitoe Cove Greenland	1776	59 36
Monterrey	1795	12 22 E.
Montserrat	1765	5 32
Newfoundland		
Fort St. Pierre	1772	19 15 W.
Nutka	1778	19 45
	1792	18 22 E.
Norton Sound	1778	25 45
Norriton	1770	3 8 W.
Porto Bello	1704	7 25 E.
Pisco	1707	7 0
Paraibo	1698	5 35
Quito	1742	8 30
Quebec	1649	16 0 W.
	1686	15 30
Rio Janeiro	1768	7 34 E.
	1787	6 12
Resolution Island	1615	24 6 W.
Savage Island	1615	27 30
Smith's Sound	1616	57 0
Santiago, Chili	1794	14 28 E.
Sebalt Island	1683	23 10
	1707	23 0
Spitzbergen		
Bell Sound	1613	13 11 W.
Cross Rheid	1596	16 0
Horn Sound	1610	16 0
	1613	12 37
Magdalen Sound	1614	25 0
Poopy Bay	1613	15 21
Read, Beach	1596	16 0
Vogelsang	1773	20 38
Unalashka Samganoodha Harbour	1778	19 59 E.
Vera Cruz	1769	6 40
	1776	7 30
Valparaiso	1709	9 30
	1795	14 49
Valdivia	1670	8 60
Pr. Wales' Fort	1725	21 0 W.
	1742	17 0
	1769	9 41
Ylo, Peru	1710	6 38 E.
York, New	1686	8 45
	1723	7 20
	1789	4 20

The following table, which Professor Hansteen was so kind as to communicate to us before his departure for Siberia, is a continuation of the tables which he published in his able work, entitled *Utersuchungen uber den Magnetismus der Erde.* Christiania, 1819, and which we have already given.

TABLE XI.—*Containing the Variations of the Needle according to the latest observations.*

Names of Places.	Year of Observation.	Magnetic Variation.
I.—*Denmark, Norway, Sweden, and Finland*		
Anholt Island	1788	19° 8′ W.
Abbo Finland	Sept. 27, 1825	11 20
Brahestad Finl.	Sept. 1825	10 38
Christiansand	Mar. 18, 1782	20 0
Christiania	May 17, 1780	18 42
	Mar. 10, 1817	20 3
	May 24, 1822	19 47
Dagerort Isl.	1800	12 0
Fredriksteen Norw.	Mar. 24, 1799	18 0
Jinnska Utön	1800	13 00
Gran Norw.	1821	18 50
Hammarfest	1823	11 26
Gottska Sandoe	1800	14 40
Landsort Sw.	1800	15 20 W.
Nörtstaböe Norw.	1821	22 12
Pitea Sw.	1825	10 6
Svarfvarort Sw.	1800	13 40
Throndhjem Norw.	July 28, 1825	19 36
Tornea Finnl.	Aug. 1825	12 7
Ullensvang Norw.	1821	22 51
Uleaborg Finl.	1791	10 0
	1825	9 32
Uloma Cassel N.	Sept. 1761	10 45
Wardoe Norw.	July 7, 1816	5 57
Wasa Finl.	Oct. 4, 1811	11 45
	Apr. 25, 1825	12 38
II.—*Russia.*		
Astracan	Apr. 17, 1580	13 40 W.
Archangelsk	1800	0 30 W.
	1824	2 7 E.
Colmogro	May 23, 1557	5 10 E.
Dogs-nose	June 2, 1557	4 0 E.
Jokanskish Isl.	1800	1 30 N.
	1824	1 7 E.
Kildin Isl.	1824	1 2 W.
Krakau	1821	14 30 W.
Matotschki, Nov. Zem.	1769	3 30 E.
	1824	10 34 E.
Olenish Isl.	1824	1 23 W.
Mescwa	Aug. 1732	5 26 W.
	1790	3 47 W.
	1805	5 24 W.
Petersburg	June 1817	7 15 W.
	Sept. 1818	7 27 5
Peczora	July 17, 1556	3 30 W.
Seven Islands	1824	0 30 W.
Tri Ostrowe Isl	June 16, 1557	3 30 E.
Udinsk	1805	2 40 E.
Waigats Isl.	1556	8 0 W.
III.—*Germany, Netherlands and Switzerland.*		
Aurich Neth.	Mar. 1819	20 43 W.
	June 1821	20 46½
	Sept. 1821	20 35
Berlin	Oct. 14, 1825	17 40
Bentheim	Nov. 11, 1817	19 41
Bochholt	1822	20 58
Emden	1816	20 42
Kirchesepe	Sept. 30, 1817	20 18½
Kremsmunster	1815	17 20
	1820	16 20
	1824	16 25
Leipzig	July 12, 1825	17 45
Meppen	Sept. 11, 1817	20 37
Nordhorn	Nov. 12, 1817	19 53
Wisens	Apr. 1821	20 32
Wittmund	July 1821	20 36
IV.—*France.*		
Brest	1818	25′ 7′ W.
Cherbourg	1813	26 47
Havre de Grace	Sept. 26, 1768	19 12
Lyons	Nov. 1751	15 45
	Dec. 1755	16 30
	1761	18 45
Ouessant Isl.	Dec. 1806	26 45
Paris	Oct. 12, 1816	22 25 W.
	1819	22 29
	Oct. 3, 1829	22 12
Toulon Cape Side	Apr. 25, 1811	19 10
V.—*England.*		
Edinburgh	Oct. 29, 1808	27 31.8
	Nov. 3, 1809	27 35.2
	Sept. 29, 1812	28 8 0
	July 9, 1823	27 48 0
Gravesend	June 12, 1576	11 30 E.
Hermitage Hill, Leith	1823	27 0 W.
London	June 1806	24 8.6
	Oct. 1812	16.5
	June 1816	17 9
	1820	11.7
	1823	9.8
Stromness, Orkney	June 3, 1819	27 50
VI.—*Portugal, Spain, and Italy.*		
Alicante	Sept. 4, 1800	19 25
Aulona	1818	14 0
Barcelona	1785	18 0
Budua	1818	14 56
Cadiz	Oct. 29, 1768	19 12
Carthagena	March 1789	18 45
	June 2, 1798	19 3
Cabrera Isl.	Sept. 29, 1789	19 0
Corunna	1806	20 47
Durazzo	1818	15 58
Eba	June 15, 1818	18 19
Portoferraio, Piombino	June 16, 1818	16 29
Fiumicino	—— 19, ——	17 45
Gorgonna	—— 2, ——	19 0
Girgenti	July 18, 1818	17 30
Ischia	June 16, 1798	18 22
Lagos Bay	Oct. 25, 1788	18 0
Leghorn	—— 20, 1731	9 42
	1785	18 0
	1795	19 20
	Jul. 8-11, 1818	19 20
Lissabon	1811	22 45
Maritimo	Aug. 6, 1807	19 40
Maritimo Isl.	May 28, 1818	17 0
	July 16, 1818	18 0
Malaga Bay	Dec. 1, 1788	19 50
Malta	1612	11 0
Minorca, C. Mola	Apr. 15, 1811	19 30
Palermo, C. Guals	1790	17 0
	1814	18 30
Ustica	July 15, 1818	17 30
Vido Ft. Alessandro	——	14 34
VII.—*Hungary and Turkey.*		
Constantinople	1797	12 33
Corfu	1818	14 34
Maudry Bay	1793	13 20
Imbro Isl. Dard.	Aug. 27, 1807	12 32
Trebizonde	1797	8 14
VIII.—*Asia and neighbouring Islands.*		
Alceste Island	July 21, 1816	2° 3′ W.
Basil's Bay	Sept. 4, 1816	2 0 W.
Bata Harbour	Apr. 15, 1803	1 23 W.
Bildih	June 11, 1580	10 40 W.
Cheaton Bay	Aug. 22, 1816	2 10 W.
Cape Comorin	Mar. 30, 1815	2 9 E.
Congo River	July 1816	25 58 W.
Pointe de Galle, Ceylon	Apr. 2, 1814	2 15 E.
Trincomalee	Sept. 27, 1812	1 9 E.
Derbent	Oct. 1580	11 0 W.
Hyderabad	June 27, 1804	1 16 E.
Batavia, Java	July 29, 1814	0 17 E.
Sourabaya	Oct. 1793	2 31 W.
	Sept. 1824	0 10.4 W
Lam-Get Isl.	June 16, 1816	0 9 W.
Macao	Apr. 21, 1792	1 12 E.
Madras	1809	3 0 E.
Morebat Bay	1781	6 40
Muscat Cove	1785	6 0
Mocha	1795	11 0
Murray's Sound	Sept. 8, 1816	2 0 W.
Napikiang Roads		
Port Melville	Oct. 8, 1816	0 52 W.
Pecho Mouth	July 27, 1816	2 14 W.
Princes Isl.	May 16, ——	20 7 W.
Sandy Isl.	July 27, ——	2 14 W.
Achen, Sumatra	May 1, 1814	2 25 E.
IX.—*Africa and neighbouring Islands.*		
Alexandria	May 11, 1694	12 48 W.
	Apr. 8, 1822	10 58
Alboran I.	Jan. 8, 1818	21 28½
Africa Islands	1802	7 44
Ascension	1816	15 30
	Jan. 1825	16 52
Akromar	March 1823	11 16
Ambucol	Apr. ——	10 46
Fagel, Azores	1814	23 30
Bareedy Harb.	1776	13 53
Bomba	1821	14 55
Bourbon St. Denys.	Aug. 10, 1813	17 20
Canaries		
Funchal	1802	19 10
	1811	21 0
	1813	22 0
	1816	21 10
	Feb. 1829	21 32
	Mar. 24, 1819	19 10
	July 5, 1821	25 58
S. Cruz Bay, Teneriffe	1816	21 20
Orotava	——	20 33
S. Cruz	Feb. 16, 1819	18 53
	Aug. 29, 1822	21 0
Chagos (Diego Garcia)	1786	1 59
Eleven Islands	——	2 10
Comorrish Islands		
Mayotta	1750	20 0
Cape Verd Isl.		
Porto Praya	1812	10 15
	Mar. 18, 1819	13 30
Bonavista	Apr. 8-9, ——	14 2
Mayo	Apr. 1819	13 9
Sal	Feb. 26, 1819	14 5
Mauritius, (Gard. Pr.)	Aug. 1805	11 42½
	Mar. 15, 1813	16 40
	Oct. 1824	13 46

ames of Places.	Year of Observation.	Magnetic Variation.
of Good Hope	1792	24° 30′
ole Bay	1813	28 0
oe Town	——	27 30
e	1801	16 0
	1815	19 35
	Mar. 21, 1819	15 50
hs Isl.	—— 4, 1732	0 0
	Dec. 1813	11 51
cs Bay	1799	11 15
elena	Apr. 1793	15 28
stown	1815	17 30
	1816	17 30
stown	Dec. 1824	19 34.5
mbique Harb.	1802	18 40
lagascar		
jambo B.	Feb. 1803	16 25
rvundava	Aug. 1714	22 30
gustin's B.	1798	23 30
	1804	24 0
mbatooka B.	1802	17 30
rcenda B.	——	15 50
	1751	16 17
e Wales Isl.	1819	22 30
f Cape	Aug. 1797	26 40
	1814	29 20
lgate	1810	5 20
Harb	1777	12 6
an d' Acunha	Mar. 6, 1813	9 51 N.
li	1816	16 60
	June 1822	16 35
homas's I.	May 20, 1816	22 48
a Isl.		17 22
X.—*America and neighbouring Islands.*		
ulco	Apr. 29, 1791	7 44 E.
	1821	8 46 E.
	1713	8 0 E.
	1821	10 25 E.
co	——	18 22 E.
n	——	10 25 E.
's three Isles	July 12, 1818	0 44 W
s Californa	Apr. 12, 1791	7 28 E.
	1821	8 40 E
don House	1808	12 12 E.
ake	1807	8 0
le B. Barbadoes		4 30 E.
goa	July 18, 1704	6 40 E.
	May 24, 1814	4 0 E.
	Mar. 10, 1818	2 1 E.
an	1787	7 0 E.
	1815	6 15 E.
o Castle	1821	10 3 E.
agena	Nov. 1735	8 0 E.
	Jan. 1787	11 0
	May 181.	6 32
Coles	1821	10 18 E.
ton House	1807	15 16 E.
ewyan Fort		16 0 E.
nna, Cuba	1815	7 0 E.
	Aug. 1816	5 30
e	Sept. 20, 1799	3 15

Names of Places.	Year of Observation.	Magnetic Variation.
S. Carlos de Chiloe	Feb. 8, 1790	17° 36′ E.
Conception	Nov. 21, 1791	14 52 E.
Coquimbo	1712	10 0 E.
	Apr. 28, 1791	11 46
	1821	14 0
Callao de Lima	1713	10 0 E.
	June 7, 1791	9 37½
	Mar. 3, 1823	9 30
S. Catharina	Oct. 1822	6 25 E.
Churchill Fort	1807	5 39 E.
S. Croix Island	July 14, 1826	1 15 E.
Dominica	June 22, 1760	3 20 E.
Pr. Rupert Bay	Apr. 8, 1819	2 40 E.
Puerto Deseado	Dec. 7, 1789	19 50 E.
Domingo		
C. Francais	1745	5 15 E.
Alta Vela	Feb. 1818	5 21 E.
Port Egmont	Dec. 19, 1790	22 34 E
Erie Fort	1817	1 42 E.
Sta. Fé de Bogota		7 35 E.
Fernando Noronha	May 1745	2 10 E.
Guayra	Jan. 24, 1800	4 20 E.
	June 3, 1814	4 53
Guayaquil	Oct. 11, 1791	9 11 E.
	1821	9 5
Guadaloupe	1809	4 55 E.
Guasco	1821	13 30 E.
Hare Island	June 1818	71 58 W.
Juan Fernandez	1744	8 30 E.
	1802	14 0
Jamaica, P. Royal	Nov. 1789	6 30 E.
	1817	4 40
Lima	Dec. 1740	9 2 E.
	1802	9 50
Mexico	Dec. 1803	8 8 E.
Mobile Bay	—— 1814	6 30 E.
Martinique	1735	6 0 E.
F. Royal	1816	6 45
S. Martha	1742	6 35 E.
Mas-a-fuera	1802	13 0 E.
Mohawk Bay	1815	0 4 E.
Port Mulgrave	July 1, 1791	26 40 E.
Le Maire Str.	1712	24 0 E.
Mollendo	1821	11 5 E.
Mocha Isl.	1821	19 34 E.
Montevideo	Sep. 23, 1789	13 40 E
	Aug. 1807	13 20
Monterras	Sep. 23, 1791	10 56 E.
Niagara Fort	1817	1 27 E.
Nuacho	1821	9 36 E.
Nootka	Aug. 17, 1791	22 30 E.
Panama	Nov. 1775	7 49 E.
	Dec. 3, 1791	7 49
	1802	8 0
Payta	1821	7 0
	1821	9 0 E.
	Mar. 8, 1823	8 56 E.
S Pescadores	1821	11 20 E.
Porto-Bello	Nov. 1735	8 40 E.
	1814	8 30
	1815	6 0

Names of Places.	Year of Observation.	Magnetic Variation.
P. of Wales Fort	1798	1° 0′ E.
	1807	5 39
	Sep. 3, 1813	6 0
Pernambuco	1815	3 0 W.
Penedo S. Pietro	1813	6 0 W.
La Plata	1741	8 30 E.
Cuito	Feb. 1802	9 24 E.
Realeyo	Jan. 23, 1791	9 20 E.
Rio Janeiro	1821	3 21 E.
Talcahuana	Nov. 21, 1793	14 52 E.
	1821	15 30
Fort Galvez	Feb. [illegible]	16 16.4
St. Thomas Isl.	1816	2 24 E.
Vera Cruz	Mar. 15, 1769	6 28 E.
	1815	10 37
	Apr. 27, 1819	9 16
Valparaiso	Mar. 11, 1709	9 30 E
	1744	12 30
	Mar. 20, 1709	12 39
	1795	14 49
	1802	14 55
	1821	14 43
Valdivia	1788	17 30 E.
S. Vincent's Isl.	Mar. 31, 1814	7 30 E.
William's Fort	Dec. 8, 1816	5 30 E.
Wollaston's Lake	[illegible]	18 2 E
Ylo	[illegible]	10 30 E
York Fort	1807	4 55 E.
	Sep. 1819	6 0.3 E.
XI.—*Australia.*		
Amboyna	Oct. 1823	0 28 E.
Bouroa, Cayeli,	Sep. 29, 1823	8 31.8E.
Ceram, Selema Bay	July 1796	8 41 E.
Dory Harbour, N. G.	—— 1824	1 35.6E.
Galapagos, Isl.	1821	8 20 E.
Guaxon Marian Isl.	Feb. 22, 1792	3 16 E.
Jervis Bay	[illegible]	9 0 E.
King's I. Elephant Bay	1802	3 30 E.
Manilla	July 18, 1792	0 17½E.
Manava Port, N. Zeal.	Apr. 1824	13 21.6E.
N. Caledonia		
Port S. Vincent	1803	10 56 E.
Oyster Bay, New Hol.	1789	6 40 E.
Otaheite Point	May 1823	6 40.4E.
Offak	Sep. 1823	1 1.7E.
Port Praslin	Aug. 1823	6 40.4E.
Pulo Leah	Mar. 1, 1816	0 52 W.
Pulo Penang	1787	0 11 W.
Port Cornwallis	1809	1 57 E.
Port Phillip	1802	3 [illegible] E.
Port Jackson	Mar. 18, 1793	8 46 E.
	Jan Feb. 1824	8 56
Paramatta	Oct. 23, 1822	8 43.8E.
	Feb. 10, 1813	0 46.8
	Mar. 26, ——	0 47.5
	Mar. 27, 1813	8 50.5
	—— 31, ——	0 43.5
Halan		
Havre de la Coquille	June 1823	9 20.5E.

Such are the leading facts respecting the dip and variation of the needle. The first attempt, we believe, to project them, was made by one Churchman, who traced lines through all the points of the globe where the *variation* was 0°, 5°, 10°, &c. and also lines through all those parts where the dip was 0°, 5°, 10°, and which he called *lines of equal variation*, and *lines of equal dip*. These lines, as projected by Churchman, are given in the Mercator's chart, in our article Geography, Plate CCLXIX. from the inspection of which it will be seen that the lines are clearly related to *four* points or poles, *two* in the northern, and *two* in the southern hemisphere.

About the year 1811, professor Hansteen of Christiania, devoted his attention to this curious subject, and has pursued it with a diligence and a success which cannot be too highly praised. The results of his first investigations were published in his able and learned work, "On the Magnetism of the Earth," (*Untersuchungen uber Magnetismus der Erde*, 1819.) By means of all the observations which he could collect, he was able to prove that there were *four points of convergence* among the lines of variation, a weaker and a stronger point being in the vicinity of each pole. Each of the stronger poles lies nearly diametrically opposite to the other, and the weaker poles have the same relative position. From a comparison of the observations made at different times, he found that these poles had a constant motion.

The motion of both the northern poles is from W. to E. obliquely, and of both the southern ones also obliquely from E. to W. With regard to the velocity of their motion, Prof. Hansteen acknowledges that the observations are not sufficiently numerous, but he has obtained the following results:

N is the *strongest* pole in the *north* hemisphere, and its revolution round the north pole of the earth is performed in 1740 years.

S is the *strongest* pole in the *south* hemisphere, and its revolution round the south pole of the earth is performed in 4609 years.

n is the *weakest* pole in the *north* hemisphere, and its revolution is performed in 860 years.

s is the *weakest* pole in the *south* hemisphere, and its revolution is performed in 1304 years.

Year,	Pole N, Strongest Pole in North Hemisphere.		Pole S, Strongest Pole in South Hemisphere.		Pole *n*, Weakest Pole in North Hemisphere.		Pole *s*, Weakest Pole in South Hemisphere.	
	Distance from the *North* Pole.	Long. West from Greenwich.	Distance from the *South* Pole.	Long. East from Greenwich.	Distance from the *North* Pole.	Long. East from Greenwich.	Distance from the *South* Pole.	Long. West from Greenwich.
1800,	20° 7′	93° 33′	20° 53′	134 8	4° 36	131° 43′	12° 10′	130° 28′
1810,	20 15	91 28	21 1	133 21	4 42	135 54	11 57	133 14
1820,	20 22	89 24	21 8	132 35	4 48	140 6	11 44	135 59
1830,	20 30	87 19	21 16	131 47	4 54	144 17	11 31	137 45
1840,	20 38	85 15	21 23	131 1	5 0	148 28	11 19	140 31
1850,	20 46	83 10	21 31	130 14	5 6	152 40	11 6	143 16

Since this table was computed, Professor Hansteen has obtained many new sets of magnetical observations, and particularly those which have been made during the British Voyages of discovery to the Arctic Regions. These he has diligently compared, and he has thus obtained new determinations of the position and times of revolution of the magnetic poles of the earth. The results of these we shall now lay before our readers in a very abbreviated, but, we trust, intelligible and useful form.

1. *On the Position, &c. of N. the strongest Magnetic Pole in North America.*

By combining four observations on the declination of the needle, made on board his Majesty's sloop Brazen in Hudson's Bay, in 1813, and which Prof. Hansteen inspected in the Marine Chart office at the Admiralty in London, he obtained the following results:

	Distance of the Pole N from the Pole of the Earth.	Lon. West of Greenwich.
1813,	21° 44	93 35
	23 40	92 18
	22 9	91 22
	23 47	92 21
Mean,	22 59	92 24

By placing this result beside former determinations, we have,

	Distance of N. from Pole.	Lon. West of Greenwich.
1730,	19 15	188° 6′
1769,	19 16	100 2
1813,	22 59	92 24

Hence we have,

Motion of the Pole N. to the East.		Annual Motion.
From 1730 to 1769,	-	12′.44
From 1769 to 1813,	-	10 .41
Mean motion,	- -	11′.425

Period of complete revolution, 1890 years

These results have received a very remarkable confirmation from the observations both of the variations and dip made during the voyages of Capt. Ross and Capt. Parry. In August 1819, Capt. Parry was north of the magnetic pole, and from his measure of the dip, viz. 88° 37′, on the 11th September 1819, the expedition must have been about 3° north of the magnetic pole; but they were then in 74° 27′, consequently the pole must have been in 71° 27′, or its distance from the pole of the globe must have been 18° 33′. We may therefore conclude, that the position of the strongest pole N in the northern hemisphere is well determined.

2. *On the Position of S. the strongest Magnetic Pole in the Southern Hemisphere, south of New Holland.*

By combining the observations made by Captain Cook in 1773 and 1777, and those made by Fourneaux in 1773, Professor Hansteen has obtained the following results, from which two of the most discordant are rejected:

	Distance of the Pole S from the Pole of the Earth.	Lon. East of Greenwich.
	20° 26′	138 7′
	20 58	135 12
	21 30	132 17
	19 17	136 31
	19 53	136 25
	20 27	138 29
	19 39	138 11
	21 18	131 21
Mean,	20 33.5	136 15′.4

But, in the year 1642, Prof. Hansteen found these positions, from the observations of Jansen Tasman, to be,

Distance from Pole, - .	18° 55′
Lon. East of Greenwich,	146 59

Hence, in 131 years, the pole S has moved *westward* 10° 14′ or 4′.69 per annum.

Its period of complete revolution will be 4605 years.

3. *On the Position of n, the weakest Magnetic Pole in the North Hemisphere in Siberia.*

By combining a number of observations made in 1805 at Tobolsk, Tara, and Udinsk in Siberia, Professor Hansteen obtained the following results:

	Distance of *n* from the Pole of the Earth.	Lon. East from Greenwich.
	4 27	116 27
	4 50	115 51
Mean,	4 38 30′	116 19

But, in 1770, Professor Hansteen found the positions of this pole to be,

Distance from Pole in 1770, -	4 14′
Lon. East from Greenwich,	91 29 30″

Hence in 35 years, the pole *n* has moved 14° 35′ 30″, or 35.′128 per annum.

Hence it appears, *that the magnetic pole n has* a motion from west to east, and that its period of complete revolution is 860 years.

4. *On the position of s, the weakest Magnetic Pole in the Southern Hemisphere south of Terra del Fuego.*

By combining the observations made by Captain Cook and Fourneaux in 1774, Professor Hansteen has obtained the following results:

	Distance of the Pole *s* from the Pole of the Earth.	Lon. West from Greenwich.
	12 36	[illegible] 52
	12 44	122 21
	13 15	120 42
	12 46	124 7
	12 47	123 48
Mean,	12 [illegible]	123 17′

But, in 1676, from observations mentioned by Halley in the *Phil. Trans.* No. 48, Professor Hansteen found the position of this pole to be,

Distance from the Pole in 1670, .	15° 53′
Lon. West from Greenwich, .	94 33½

Hence, in 104 years, the pole *s* has moved *westward* 28° 43½′ or 16′.57 annually; and we have its period of complete revolution, 1303 years.

From these determinations, it appears that *the two magnetic poles in the northern hemisphere, N and n, move* eastward, *while the two S, s, in the southern hemisphere move* westward.

As the poles N and S are nearly about the same distance from the terrestrial poles, and, therefore, almost diametrically opposite, and as they are also much stronger than *n* and *s*, Professor Hansteen properly assumes, *that N and S are the terminating points of one magnetic axis, and n and s those of the other axis.* Therefore, says he, these two magnetic axes cross without intersecting one another, or passing through the centre of the earth. The centre of both lie much nearer the surface in the South Sea than in our hemisphere.

In answer to the question which naturally arises respecting the cause of these remarkable phenomena, Professor Hansteen makes the following observation: It is possible that the illumination and heating of the earth, during one revolution about its axis, may produce a magnetic tension, as well as it produces the electrical phenomena, and that the change of position in the magnetic axis may be explained from a change of position in the earth's axis to its orbit.

Professor Hansteen next proceeds to show how the changes in the variation and dip of the needle may be explained by the motion of the magnetic poles; and he begins with the observations made at Paris, where the variation was as follows:

Years.	Declination of the Needle.			Years.	Declination of the Needle.		
1541	7°	0	East.	1667	0°	15	West.
1550	8	0		1670	1	30	
1580	11	30	Maximum.	1680	2	40	
1603	8	45		1683	3	50	
1630	4	30		1709	7	40	
1640	3	0		1800	22	12	
1659	2	0		1807	22	34	
1664	0	40		1814	22	51	Maximum.
1666	0	0	No Variation.	1829	22	12	

Now it appears that, in 1580, the Siberian pole *n* was about 40° east of Greenwich, or to the north of the White Sea, while the North American pole N was about 136° west of Greenwich, or about 30° east of Behring's Straits. The pole *n*, therefore, lay *nearer* Europe than now, and the pole N was *more remote*. Hence the former exercised a predominant action, and the needle turned towards the east. In the mean time, the pole *n withdrew* itself towards the Siberian Ocean, and as *N approached* Europe, its action increased, and the needle turned westward till 1814, when it reached its greatest declination, and since that time it is evidently returning eastward. On the very same principles we see the reason why the eastern declination was less before 1580.

The variations of the needle in the *Southern hemisphere* are explicable in the same way. At the Cape of Good Hope, and in different bays of the adjoining sea, the variation was easterly in 1605. The following are the variations since the time of Vasco de Gama:

Years.	Declination of the Needle.			Years.	Declination of the Needle.		
1605	9	30	East.	1724	16	27	West.
1609	0	12	West.	1752	19	0	
1614	1	30		1768	19	30	
1667	7	15		1775	21	14	
1675	8	30		1791	25	40	Maximum
1702	12	50		1804	25	4	

Now, in 1605, the South American pole *s* was 76½° west of Greenwich, nearly south of Terra del Fuego, and the New Holland pole S was about 150° east of Greenwich; the pole *s* was, consequently, much *nearer* the Cape than it is now, while the other pole S was *more remote* from it. The effect of *s*, therefore, was *greater*, and of S less than at present, so that the *south* pole of the needle moved more towards the *west*, and its *north* pole more towards the *east*. But as *s* went farther off, and S approached the Cape, the south pole of the needle turned more and more towards S, so that the declination became westerly.

To obtain an example from the dip, Professor Hansteen gives the following observations at Paris:

Years.	Dip.	Years.	Dip.
1671	71° 0′	1798	69° 26′
1754	72 15	1811	68 32
1780	71 40	1829	67 41

Though the dip thus *diminished* at Paris, yet it *increased* in Eastern Siberia and Kamtschatka. Both these changes are the results of the motion of the Siberian pole *n* towards the east, in which it is removed from Europe, and approaches to Kamtschatka. In all S. America the dip *decreases* in consequence of the motion of the Terra del Fuego pole *s* towards the west.

In order to discover the nature of the forces by which the phenomena of terrestial magnetism are produced, Professor Hansteen resolved to determine the intensity of magnetism in different parts of the earth's surface, and then to ascertain the form of the *isodynamical magnetical lines*, or those of equal intensity. He accordingly had a magnetic needle of a cylindrical form constructed with great care. This needle he entrusted to various philosophers, who counted the time in which *three hundred* horizontal oscillations were performed, in various parts of Norway, Sweden, Denmark, Prussia, Holland, France, England, and Scotland. The greater number of these were made by Professor Hansteen himself, many of them by M. Naumann, several by M. Erichsen, and a considerable number by Professor Oersted of Copenhagen, when he was travelling in England in 1823. Those which were made by this last philosopher in Edinburgh on the 4th of July, 1823, and at which we had the pleasure of assisting, were performed in the field behind Coates Crescent, and nearly at the intersection of Walker Street and Melville Street. These possess considerable interest, as being the most *westerly* of all that were then made.

In order to determine the intensity of the magnetic force throughout Scotland, Dr. Brewster ordered, for the Royal Society of Edinburgh, one of the instruments used by Professor Hansteen. When this instrument arrived from Christiania, where it was executed under Professor Hansteen's own eye, and furnished with one of his own needles, Dr. Brewster put it into the hands of Mr. James Dunlop, who, with his usual zeal for the interests of science, performed a tour through Scotland, in 1829, and made a most important series of magnetical observations. They, having been communicated to the Royal Society of Edinburgh, will be speedily published.

The following table exhibits the results of the observations, made by Professor Hansteen and his friends, the *first* and *second* columns containing the latitude of the place of observation, and its longitude from Ferro; and the *third* the number of seconds in which 300 oscillations are performed by the suspended needle.

Places.	Lat.		Lon. from Ferro.		Time of 300 Oscillations.	Places.	Lat.		Lon. from Ferro.		Time of 300 Oscillations.	Places.	Lat.		Lon. from Ferro.		Time of 300 Oscillations.
Berlin	52°	32′	31°	2	760″.03	Bekkervig	60°	1′	22°	50′	851″.0	Kolding	55°	27′	27°	0′	789″.1
Paris	48	50	20	0	753.03	Bratholmen	60	21	22	47	839.5	Odense	55	24	27	59	793.7
London	51	31	17	34	775.34	Bergen						Buskerud					845.5
Edinburgh	55	58	14	29	820.26	Fort Friedrichsberg	60	24	22	57	850.1	Johnsknuden					961.3
Liverpool	53	22	14	43	801.6	Friedrichsberg					850.5	Skrimfjeld					891.3
Oxford	51	46	16	24	779.8	Lunggaards, See					849.3	Rolloug	59	59	27	5	844.0
Christiansand	58	8	25	43	820.3	Lyderhorn, 1255 feet					843.7	Synhovedet					846.3
Mandal	58	1	25	9	814.3	Lövstakken, 1524 feet					904.7	Eje	60	6	26	53	838.5
Tjös					816.3	Haugs	60	27	23	18	845.2	Ejesfjeld					831.2
Carlscrona	56	7	33	13	785.3	Bolstadörn	60	32	22	43	847.7	Daglio	60	18	26	26	837.4
Ystad	55	26	31	28	779.3	Evanger	60	33	23	52	845.9	Torpe	60	40	26	47	841.5
Szrim	52	7	34	48	748.1	Vossevangen	60	38	24	16	850.6	Haavi June	61	7	26	42	851.2
Glogau	51	43	33	36	748.8	Tvinde	60	42	24	11	849.1	Sept.					850.4
Carolath	51	46	33	37	752.7	Staleim	60	52	24	19	848.9	Urland	61	0	24	55	849.2
Zelgos	53	11	32	48	759.7	Leirdalsören	61	10	25	29	856.3	Voss June	60	38	24	10	856.5
Danzig	54	21	36	18	770.4	Leirdals	61	8	25	30	852.2	Sept.					845.9
Marienburg	54	2	36	42	766.0 *	Maristuen	61	2	25	54	855.3	Age-Nuten					842.7
Goslin	52	34	34	43	759.7	Nyestuen	61	8	25	59	853.2	Vigör	60	18	24	5	850.7
Custrin	52	35	32	40	762.4 *	Vangs	61	6	26	23	845.6	Bergen	60	24	22	57	
Christiana	59	55	28	25	814.76	Slidre	61	5	26	49	853.9	Nyegaard					857.1
Friedrichshall, 1819	59	8	29	4	821.7 *	Tumlevold	60	51	27	38	843.7	Flöifjeldet					854.7
1822					830.3	Grans	60	22	28	12	842.3	Lövstakken					844.2
Quistrum, 1819	58	27	29	25	816.1 *	Moe	60	14	28	11	848.3	Friedrichsberg					851.7
1820					815.4	Sundvold	60	4	28	7	842.6	Lindaas	60	43	23	8	843.5
Hede	57	58	29	48	810.8 *	Johnsrud	59	57	28	19	841.5	Evenvig	60	58	23	8	850.6
Gothenburg 1819	57	42	29	38	812.2 *	Hurdal	60	26	28	49	827.3	Yttre-Sulen	61	4	22	45	852.1
1820					812.1	Trogstad	60	8	28	56	823.8	Stensund	61	3	22	52	852.9
Quibille	56	47	30	30	791.6 *	Sunbye 1822	59	36	28	35	826.8	Pollefjeld					861.8
Helsingburg 1820	56	3	30	23	791.1 *	Sooner	59	32	28	25	827.8	Askevold	61	24	23	7	861.1
1820					790.0 *						828.1	Vilnas	61	22	22	58	860.7
Helfingoer 1820	56	2	30	18	789.8 *	Boe	59	7	29	7	823.2	Sougesund	61	22	23	11	861.7
1820					784.6 *	Altorp	58	53	29	54	816.3	Alden	61	22	22	50	850.7
Copenhagen	55	41	30	15	783.98	Oedskjolds-Moen	58	50	29	52	816.0	Bueland	61	17	22	44	851.2
Friedrichsburg	55	56	29	58	785.9	Elleoen	59	19	28	20	826.7	Sveen					856.4
Soröe 1820	55	27	29	14	790.6	Godtskjär	57	26	29	43	809.9	Quamshest					849.8
1822					790.4	Korset	58	49	27	12	824.5	Forde July	61	32	23	48	858.9
Skieberg	59	14	28	51	826.7	Helegraae	58	59	27	34	822.7	Aug.					858.8
Kongsberg 1820	59	40	27	20	845.4	Stubberud	59	4	27	55	818.9	Jolster	61	35	24	10	848.6
1821					839.3	Solerud	59	21	28	9	826.5	Gloppen	61	51	24	6	861.9
					845.1	Konnerud-Kollen, 1823					875.5	Indvig	61	49	24	34	860.4
					837.8	Auestad	59	49	27	53	852.1	Horningdal	61	59	24	33	862.6
1821					859.5	Bragernas	59	49	27	53	848.6	Halsylta	62	7	24	54	864.8
Bolkesjö	59	43	27	0	834.9	Ravnsborg	59	52	28	17	829.5 *	Nordal	62	18	25	13	870.3
Vik					836.8	Friedrichsvärn 1824	59	0	27	44	813.5	Veblungsnäs	62	31	25	39	868.3
Tandosen					834.6	Friedrichshavn	57	27	28	15	808.1	Fladmark					862.9
Oernæs					829.1	Aalborg	57	3	27	36	806.0	Nyestuen					862.7
Ingolfsland	59	53	26	23	834.4	Sporring					799.9	Fogstuen	62	5	27	9	856.9
Moland	59	56	26	36	833.4	Aarhuus	56	10	27	54	796.0	Jerkin	62	12	27	29	846.5
Tind	60	0			835.7	Hovedkrug					798.3	Foldal	62	7	27	57	855.5
Midböen					836.8	Weile	55	43	27	12	793.9	Kongsvold	62	18	27	36	860.0
Rygsland					838.0	Apenrade	55	3	27	6	786.4	Drivstuen	62	26	27	41	858.0
Nörsteböe	60	20	26	17	839.8	Gehlau					787.9	Riise	62	31	27	41	858.1
Holmekjarn	60	17	25	24	832.8	Schleswig	54	31	27	15	793.0						859.8
Maursæter	60	25	25	3	829.3						785.5	Næverdal	62	42	28	6	858.7
Eidfjord					852.6	Remmels	54	7	27	18	783.0	Stoa	62	32	28	21	860.4
Ullensvang	60	20	24	18	840.7	Elmshorn	53	46	27	18	779.1	Gora	62	35	27	2	862.1
Johannes-Tangen					843.8	Altona	53	33	27	33	776.1	Tofte	61	58	27	10	859.3
Gjermundshavn	60	3	23	52	846.2						774.9	Vauge	61	51	27	4	860.8
Kaarevigen	59	45	23	7	838.2	Berlin	52	32	31	2	760.4	Vinje	60	52	24	22	848.2
Findaas	59	45	22	54	861.7						759.0	Nyuestuen	61	8	25	59	852.1
Siggens					824.2	Lübeck	53	51	28	21	776.2	Skoragstad	61	10	26	12	853.7
—					837.4	Plöen	54	9	28	6	780.5	Smedsbrummer	60	29	28	14	841.9
Folgeröe	59	48	22	56	835.9	Preetz	54	13	27	57	779.0	Sundvold	60	4	28	7	839.2
Engesund	59	55	22	53	840.7												

The following additional observations have been sent to us by Professor Hansteen:

Carlscrona,	735
Breslau,	741
Stockholm,	815
Hernosand,	850

These various results have been laid down on a map by Professor Hansteen; but as they occupy only a small part of Europe, we do not think it necessary to copy his chart. Any of our readers, however, may easily lay down, upon a map of Europe, the lines of equal magnetic intensity, either from the above tables, or more simply by the following directions:

1. The line of 750, or the line in which the 750 seconds are required for the performance of 300 oscillations, passes one-fourth of a degree to the south of *Paris* and *Rheims*, and one third of a degree to the south of *Gotha* and *Gaslin*.*

2. The line of 775 passes about one-third of a degree south of *London*, and through *Amsterdam* and *Lubeck*.

3. The line of 800 passes about the fifth of a degree north of *York*, *Sporring* in Jutland, and *Falkenberg* in Sweden.

4. The line of 820 passes through *Edinburgh*, and a little to the south of *Christiansand* in Norway, and *Carlstadt* in Sweden.

5. The line of 865 passes through *Hirdal* in Norway.

As the lines are almost equi-distant, and nearly parallel, all the intermediate ones may be readily inserted.

Professor Hansteen has added the following very interesting table, containing the observed dip of the needle, and the computed magnetic intensity in various parts of the world, that of the equator being unity or 1.0000. A similar table was printed in Professor Hansteen's paper, in Poggendorff's *Annalen der Physik*, but the column of intensity had been wrong computed for all the places in the north of Europe, and we are happy to be able, through Professor Hansteen's kindness, to present our readers with a corrected copy.

Places of Observation.	Dip.	Intensity.
	South.	
Port du Nord	75° 50′	1.5773
Port du Sud	70 48	1.6133
Surrobaya in Java	25 40	0.9348
Amboyna	20 37	0.9532
Lima	9 59	1.0773
Magnetic Equator in Peru	0 0	1.0000
	North.	
Tompenda	3 11	1.0191
Loxa	5 24	1.0095
Cuenca	8 43	1.0286
Quito	13 22	1.0675
St. Antonio	14 25	1.0871
St. Carlos	20 47	1.0480
Popayan	20 53	1.1170
Santa Fe de Bogota	24 16	1.1473
Javita	24 19	1.0675
Esmeralda	25 58	1.0577
Carichana	30 24	1.1575
St. Thomas	35 6	1.1070
Carthagena	35 15	1.2938
Cumana	39 47	1.1779
Mexico	42 10	1.3155
Atlantic Sea,		
B. 20° 46′ n. L. 41°. 26′ w. F.	41 46	1.1779
— 11 0 - — 44 32 —	41 57	1·2617
— 12 34 - — 33 14 —	45 8	1.2300
— 14 20 - — 28 3 —	52 55	1.2830
— 20 8 - — 8 34 —	56 42	1.2510
— 21 36 - — 5 39 —	47 49	1.2617
— 25 15 - — 0 36 —	60 18	1.2830
Portici	60 5	1.2883
Naples	61 35	1.2745
Rome	61 57	1.2642
Vesuv. Crater	62 0	1.1933
St. Cruz, Teneriffe	62 25	1.2723
Valencia	63 38	1.2405
Florence	63 51	1.2782
Atlantic Sea,		
32° 16′ n. 2° 52′ w.	64 21	1.2938
Barcelona	64 37	1.3482
Marseilles	65 10	1.2938
	North.	
Nimes	65° 23′	1.2938
Mailand	65 40	1.3121
Montpellier	65 53	1.3482
Airola	65 55	1.3090
Turin	66 3	1.3364
Medina del Campo	66 9	1.2938
Lans le Bourg Mont Cenis	66 9	1.3227
Como	66 12	1.3104
St. Michel	66 12	1.3488
Lyons	66 14	1.3334
St. Gothardt	66 22	1.3138
Mont Cenis	66 22	1.3441
Ursern	66 42	1.3069
Altorf	66 53	1.3228
Atlantic Sea,		
37° 14′ n. 3° 30′ 0″	67 30	1.3155
38 52 — 3 40	67 40	1.3155
Madrid	67 41	1.2938
Tübingen	68 4	1.3569
Atlantic Sea,		
38° 52′ n. 3° 40′ 0″	68 11	1.3155
Ferrol	68 32	1.2617
Paris	69 12	1.3482
Gottingen	69 29	1.3485
Berlin	69 53	1.3703
Carolath	68 21	1.3509
Berlin	68 50	1.3533
Danzig	69 44	1.3737
London	69 57	1.3697
Ystad	70 13	1.3742
Schleswig	70 36	1.3814
Copenhagen	70 36	1.3672
Odense	70 50	1.3650
Helsinburg	70 52	1.3782
Kolding	70 53	1.3846
Soroe	70 57	1.3842
Freidrichsburg	70 59	1.4028
Aarhuus	71 13	1.3838
Aalborg	71 27	1.3660
Odensala	71 39	1.3666
Friedrichshaven	71 48	1.3842
	North.	
Gottenburg	71° 58′	1·3826
Altorp	72 14	1·3891
Korset	72 24	1·3735
Quistrum	72 27	1·4070
Skieberg	72 29	1·3725
Elleoen	72 38	1·3340
Helgerone	72 39	1·3980
Soner	72 41	1·3835
Christiania	72 34	1·4195
Ryenberg	72 45	1·4208
Bogstad	72 34	1·4378
Bogstadberg	73 13	1·4195
Nasoden	73 2	1·4517
Bärum	72 44	1·3902
Bolkesjoe	73 15	1·4053
Ingolfsland	73 19	1·4159
Norsteboe	73 33	1·4136
Drammen	73 37	1·3771
Maursäter	73 44	1·4656
Ullensvang	73 44	1·4260
Gran	73 45	1·4221
Kongsberg	73 47	1·4144
Tomlevold	73 50	1·4246
Bekkervig	73 58	1·4114
Vang	73 59	1·4308
Bergen	74 3	1·4220
Moe	74 3	1·4254
Mauristuen	74 4	1·4058
Leierdal	74 6	1·4190
Slidre	74 34	1·4543
Brassa	74 21	1·4471
Davis Straits,		
68° 22′ n. 36° 10′ w.	83 8½	1.6365
Hare island,		
70° 26′ n. 37° 12′ w.	82 49	1.6406
Baffin's Bay,		
75° 5′ n. 42° 43′ w.	84 25	1.6169
75 51 — 45 26 —	84 44½	1.6410
76 45 — 58 20 —	86 9	1.7052
76 0 — 60 41 —	86 0	1.6885
70 35 — 49 15 —	84 39	1.6837

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* The line of 740, of which only one point has been determined, passes through Breslau.

The following table shows the law of variation from the equator to the pole.

Magnetic dip.	Magnetic intensity.
0°	1.0
24	1.1
45	1.2
64	1.3
73	1.4
76½	1.5
81	1.6
86	1.7

This valuable table of results received many additions from the experiments by Captain Sabine, in the two arctic voyages of discovery performed in 1818, 1819, and 1820, and in a voyage performed in 1822, to the equatorial shores of the Atlantic, and to some of the islands of that and the Caribbean sea, and lastly, in a fourth voyage, made in 1823, to Greenland, Spitzbergen, and Norway. But notwithstanding these valuable accessions, professor Hansteen was desirous of performing a journey into Siberia, for the purpose of establishing, by actual observation, the existence of a weaker pole in the north of Asia, and of extending the isodynamical lines of Europe as far as possible to the east. From this journey he has just returned, after the successful execution of his most sanguine wishes. We wait with anxiety for the publication of his observations; but we are enabled in the mean time to present our readers with a small chart of the northern hemisphere, as drawn by Captain Sabine from the observations communicated to him by professor Hansteen, combined with his own and with those given in the preceding table.

In this map, the full-drawn black lines pass through the stations where the magnetic intensity was observed to be equal, and the dotted parts of the same lines indicate the presumed direction of the curve in those regions where observations have not yet been made. The portions round the American pole are drawn principally from Captain Sabine's observations, and the prolongation of the same portions of the curves round the Asiatic pole are drawn from the recent observations of Hansteen. The American pole is situated nearly in 60° of North Lat. and 80° of Lon. West of Greenwich. The Asiatic pole is situated in 102° of East Lon., (180° distant from the American one) and in 60° of North Lat.

The first, or most northern curve, is that in which a needle which performed a given number of oscillations in 300 seconds in London, performed only 269 at all places under the curve. Round the Asiatic pole this curve will be seen to contain a smaller space than round the American pole, which proves the inferior activity of that pole. M. Hansteen traced the south part of this curve below 60° of latitude from the river Jenisei to the west, as far as the 115th degree of Lon.; that is, 25° beyond the Jenisei, and to the Lat. of 60°, where it takes a direction almost from S. to N.

The next curve, or that in which the same needle performs the same number of oscillations in 278 seconds. This curve goes round both the American and the Asiatic poles, including both within its arc. It passes to the N.W. of Melville Island, and to the N.E. of some stations on the west coast of Greenland, and it cuts the American coast between the Havana and New York. The same curve has been traced in Asia, by Dr. Erman, who accompanied Hansteen from the embouchure of the Oby, in Lat. 68°, and E. Lon. 70°, following the direction of the river Mina as far as Lat. 60° N. Here the curve gradually bends to the east, passes between Tobolsk and Narym, and was found again by M. Hansteen at Kainsk, a few degrees to the south of Lake Baikal.

The third curve, or that of 287 seconds, is drawn from observations made at the Havana, at the Pendulum Isles, on the east coast of Greenland, in Lat. 74° 5′ and between Spitzbergen and Hammerfest, near the North Cape. According to professor Hansteen, this curve enters the continent of Europe between Archangel and Nova Zembla; and he crossed it in going from Moscow to Tobolsk, at 56° and 57° of East Lon. and 57° and 58° of North Lat.

The fourth curve, or that of 297 seconds, passes near Jamaica, where the oscillations were 294 seconds, passes through the north part of Britain, and enters Norway to the south of Bergen. It passes between Stockholm and Tornea, and thence by St. Petersburg and Moscow.

These four curves are the only ones that lay within the sphere of observation of professor Hansteen. The rest of the curves in the map were laid down by Captain Sabine, principally from his own observations and those of Humboldt.

Although the preceding investigations go far to point out the form of the isodynamical magnetic lines, yet much remains to be done before the blanks are filled up, and the lines traced round the poles of the southern hemisphere.

The most important and the most difficult part of the problem which still remains, is to ascertain the velocity with which these poles revolve; and we entertain sanguine hopes that, in consequence of the recommendation of Baron Humboldt,* and the zeal of the Academy of Sciences of St. Petersburg, a regular system of observation will be immediately set on foot by the Russian government, to obtain an early solution of this great scientific question. The empire of Russia is actually traversed by *two lines of the variation.* One of these lines, according to the recent observations of Hansteen and Erman, passes between Mourum and Nijni-Novgorod, and the second some degrees to the east of Irkutsk, between Parchiuskaia and Torbinsk. It is proposed to determine with great precision every *ten* years the exact position of these two lines. Petersburg, Moscow, and Kasan are situated near the first line of no variation, which traverses Russia in Europe. Kiachta and Verkhné-Oudinsk present advantages for the second line, which passes through Siberia. In the space of twenty years, therefore, as Baron Humboldt has remarked, and by means of accurate instruments, Russia may make a gigantic progress in the theory of magnetism.

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* See Dr. Brewster's *Journal of Science*, No. IV. New Series, April 1830.

The magnetic action of the globe is not only subject to secular inequalities, but also to diurnal, and even hourly variations. In Europe the variation is most easterly about 8 or 9 o'clock in the morning, and most westerly about 1 or 2 o'clock in the afternoon; the needle then moves eastward till about 8 or 9 o'clock in the evening, when it continues stationary for an hour or two, or makes a slight movement to the west, so that at about 8 in the evening it is a little farther to the east than it was on the preceding evening.

About the summer solstice, the common diurnal variation is nearly twice as great as about the winter solstice, being in the first case about 15′ and in the last about 7½′. There is also a regular monthly motion, in virtue of which the needle travels westward from the summer solstice to the vernal equinox, and eastward from the vernal equinox to the summer solstice.

The diurnal variation increases from the equator to the poles. In Iceland and Greenland the needle attains its most westerly position at from 8 to 10 in the evening; in Europe and the United States from 2 to 3 in the afternoon; in Sumatra about 7 in the morning; in St. Helena about 8. It attains its most easterly position in Europe and North America about 7 or 8 in the morning; in Iceland and Greenland about 9 or 10; in Sumatra about 5 in the evening; and at St. Helena about 6 (or two.) On the northwest coast of America it seems to reach its most westerly position in the forenoon, and its most easterly in the afternoon. These daily oscillations appear to consist of four movements, two directed eastward and two westward.

Besides these regular oscillations, the needle is subject to sudden and extraordinary movements, which baron Humboldt calls magnetic hurricanes, during which the needle traverses, frequently with a shivering motion, or one of several degrees, on both sides of its usual position. These disturbances have often been noticed during the existence of the aurora borealis; and yet captain Foster, when in the arctic regions, was never able to observe the slightest effect produced upon his needles by the most vivid auroræ.

The dip of the needle undergoes analogous variations, but a few experiments only seem to have been made on this part of the subject. M. Hansteen, from a series of observations made with a dipping needle by Dollond, found that the dip during the summer was about fifteen minutes greater than what it was during the winter, and about four or five minutes greater in the forenoon than what it was in the afternoon.

Similar variations are observed in the magnetic intensity of the earth. The minimum of the daily variation of intensity is between 10 and 11 in the forenoon, and the maximum between 4 and 5 in the afternoon. The intensity is a maximum in December, and a minimum in June. The greatest monthly variation is a maximum in the months of December and June, about the time when the earth is in its perihelion or aphelion. It is a minimum near the equinoxes, or when the earth is at its mean distance from the sun. The greatest daily variation is least in the winter, and greatest in the summer. The greatest difference of the annual variation is 0.0359. M. Hansteen has also found that the intensity is decreasing in Europe, and that the decrease is greater in the northerly and easterly parts than in the southern and westerly, an effect obviously produced by the motion of the Siberian pole towards the east.*

During Captain Parry's voyage of 1824 and 1825, a remarkable diurnal variation of the needle was discovered at Port Bowen. The maximum westerly variation was found to occur between 10 A.M. and 1 P.M., and the minimum between 8 P.M. and 2 A.M. The exact time of the maximum as deduced from a mean of 120 days, was 11° 49′ A. M. and that of the minimum 10° 1′ P. M. The amount of the diurnal variation was seldom less than 1½° or 2°, and it sometimes rose to 5° 6′, and even 7°. Captain Parry likewise observed an increase in the magnetic intensity from the morning till the afternoon, and a decrease from the afternoon to the morning.

Various hypotheses have been invented for the purpose of explaining the variations of the needle. Halley at first† supposed that the earth is a great magnet, having four magnetical poles or points of attraction, two being near each pole, and he endeavoured to fix the position of these poles; but when he considered that no magnet was known to have more than two poles, he abandoned this hypothesis as insufficient to account for the phenomena, he devised the following hypothesis.‡ He conceives the earth to consist of an external shell, which is a magnet, having its two fixed poles distant from the poles of rotation, and he supposes that there is an internal nucleus or inner globe included in the external shell, and separated from it by a fluid. The nucleus, which is also a magnet with two poles, has the same centre and axis of diurnal rotation with the external shell, "only this outer sphere having its turbinating motion some small matter either swifter or slower than the external ball. And a very minute difference in length of time, by many repetitions becoming sensible, the internal parts will by degrees recede from the external, and not keeping pace with each other, will appear gradually to move either to the east or west by the difference of their motions." This displacement of the internal nucleus, therefore, occasions a change of place in its magnetic poles, and furnishes a rude explanation of the principal facts; but the hypothesis is too wild to be admitted into science, and is besides totally insufficient to explain many of the phenomena.

The general opinion among modern philosophers is, that the magnetism of the earth is related to its temperature, and this opinion may be considered to have received a most striking confirmation, when Dr. Brewster proved by an extensive series of observations, that the temperature of our globe is related to two poles of maximum cold distant from the poles of rotation, and related in position to the magnetic poles.[*] The two cold poles seem to have different intensities like the magnetic ones, and by supposing them to have a motion of rotation either contemporaneous with, or independent of, the magnetic poles, we may explain those remarkable changes of temperature which have obviously taken place at the same points of our globe. The earth may be conceived to be a great magnet, and then the intensity of its magnetism, at any point, will be inversely as the temperature of that point. Or it may be considered like a piece of soft iron, and as deriving its magnetism from the sun or planets, and in this case the intensity of its magnetism will increase with its temperature. The first of these opinions has been most generally adopted, but the second has acquired great probability from the connexion of the diurnal variation with the motions of the sun, and from the magnetic influence of the solar rays, though this latter influence has again become a matter of well founded doubt.[†] Mr. Kupffer of Casan has endeavoured, in a very ingenious memoir, to prove that terrestial magnetism resides on the surface of the globe.

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* Dr. Brewster's *Journal of Science*, No. X. p. 221.

† *Phil. Trans.* 1683, Vol. XIII. No. 148, p. 208.

‡ *Phil. Trans.* 1692, Vol. XVII. No. 195, p. 563.

From a more recent comparison of observations, Dr. Brewster has given the following general formula for the mean temperature at any point of the earth's surface;

$$T = (t - \tau)(\sin^n. \delta. \sin^n. \delta') + \tau$$

in which $T =$ the mean temperature required.
$t =$ the maximum equatorial temperature.
$\tau =$ the minimum temperature at each of the cold poles.
$\delta, \delta' =$ the distances of the place from the two cold poles.

The distances $\delta\,\delta'$ are found from the formulæ

$$\cos. \delta = \frac{\cos. L\,(\cos. L - \theta)}{\cos. \theta} \text{ and}$$

$\tan g. \theta = \cos. M. \tan g. L$, where L is the co-latitude of the pole of maximum cold, l the co-latitude of the place, and M the difference of longitude between the place and the pole.

The above formula is founded on the supposition that the poles of maximum cold are placed in opposite meridians, and have the same temperature, and it gives a series of returning curves of the nature of Lemniscates. The values of t and τ are already determined with considerable accuracy, t being nearly 82°.8 and τ from 0° to 3½°. The exponent n is nearly $\frac{5}{8}$, though future observations may induce us to increase or diminish it. Dr. Brewster finds the observations to be the best represented by placing the American pole in Lat. 73° N. and Lon. 100° W. a little to the east of Cape Walker, and the Asiatic pole in Lat. 73° N. and E. Lon. 80°, between Ubino and Cape Mazol on the gulf of Oby. Hence the two warm meridians will be in West Lon. 10° and East Lon. 170°, the latter passing through Lord Mulgrave's range, and the former between St. Helena and Ascension island. The two cold meridians, or those which pass through the poles of maximum cold, will be in W. Lon. 100° and E. Lon. 80°, the latter passing near Mexico and through Bathurst Island, and the former through Colombo in Ceylon, Berar in Hindostan, and crossing the Oby a little to the west of Narym in Siberia.

Now the same formula will be found, so far as observations at present indicate, to express the magnetic intensity at any point of the earth's surface, on the supposition of the intensity of the two magnetic poles being equal, calling S the maximum number of seconds in which any number n of oscillations are performed, which takes place at the island of St. Thomas, on the west coast of Africa, and s the minimum number of seconds in which n oscillations are performed, which takes place at the magnetic poles, then the intensity I will be

$$I = (S - s)(\sin^n. \delta. \sin^n. \delta') + s$$

δ and δ' being determined by the formulæ already given, adopting the position of the poles, as given in the preceding page. According to Captain Sabine and Hansteen, the values of S and s will be about 370″ and 262″ or 263″. This formula will give a series of returning curves of the nature of Lemniscates, almost similar to those drawn by Captain Sabine. A correction may be applied to accommodate the formula to the hypothesis of the two poles having different intensities.

It is a curious fact, however, which will require an explanation from any good theory of the magnetic variations, that though according to Hansteen the lines of equal dip and of equal intensity are sensibly parallel in Scotland, yet farther to the east, in Norway and Sweden, the latter tend more to the north, and cut the former; and also under the same line of equal dip the intensity is weaker to the east than to the west. Hence M. Hansteen has found that the pole of inclination or dip, that is, the point to which the lines of equal dip are related, lies in 71° of Lat. and 102° of Lon., while the pole of intensity is in 56° of Lat. and 80° of Lon. west of Paris.[‡]

We shall now conclude this article with a description of instruments for measuring the variation and dip of the needle, and the intensity of the magnetic force.

Description of instruments for measuring the variation and dip of the needle, and the intensity of the magnetic force.

These instruments may be thus enumerated:

1. Colonel Beaufoy's variation instrument.

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[*] See our article POLAR REGIONS, Vol. XVII.
[†] See Dr. Brewster's *Journal of Science*, No. IV. New Series, April 1830, p. 225.
[‡] See Dr. Brewster's *Journal of Science*, No. IV. New Series, April 1830, p. 260.

2. Dollond's variation transit.
3. Dollond's dipping needle.
4. Dollond's diurnal variation instrument.
5. Hansteen's instrument for measuring the magnetic intensity.
6. Mr. Barlow's correcting plate.

1. *Colonel Beaufoy's Variation Instrument.*

The first instrument for measuring the variation of the needle which we propose to describe, is that which was used by Colonel Beaufoy in his numerous magnetical experiments.

The principal part of this instrument, viz. its needle, with the box and divided arch, to measure the angle of variation, is very similar to the instrument in the possession of the Royal Society; but it is greatly improved by the addition of a small transit telescope, which very readily and accurately determines the true meridian or zero, from which the degree of the variation is to be measured. This addition renders it particularly well adapted for travellers who wish to make accurate observations in different parts of the globe, as it contains every thing necessary for the observations within itself; and as every part admits of adjustment, by reversing, it may be depended upon for accuracy.

A representation of the whole instrument in perspective is given in Plate DXXVIII. Fig. 2, which explains all its parts at once. The box containing the needle is not fixed, as in many compasses, but turns horizontally on the centre, and has an index fastened to it, pointing to a divided arch, on the brass frame on which it turns; and the method of observing is to move the box till a line drawn on it points exactly to the end of the needle, which being done, the angle of variation is shown by the divisions on the arch. FF is a mahogany board, which is the support of the whole instrument; it stands on the points of three screws G, H, I, by which it can be levelled. Above this is a flat plate of brass EE, attached to the board by a centre pin, and resting upon three studs, projecting from the board, to ensure its having a perfect bearing, whilst it admits of a small horizontal motion round the centre by means of the screw WX. The plate EE has the divided arch *m* fixed upon one end of it, and a vernier D traverses against the divisions; it is divided upon a projecting part of a brass plate CC, which moves on the common centre pin of the plate C, and also the needle AAB. The plate CC has two segments of brass at each end of the needle, and these have the centre lines drawn upon them, which are brought to the points of the needle when the observation is made. A light brass box *dd*, with a glass cover, is fitted over the plate CC to preserve the needle from disturbance from the wind; it also supports a small double microscope M, intended to assist in examining when the index line points exactly to the end of the needle; the stem of the microscope is fitted to a dove-tailed groove, and can be removed to the opposite end of the box at pleasure.

The centre pin of the plates E and C terminates in an extremely fine point, on which the needle is suspended, having an agate cap, B, to diminish the friction as much as possible. The needle is of a cylindrical figure, about the five hundredth of an inch in diameter, and ten inches long, and weighs 65½ grains, and is terminated by two conical points; the circular enlargement of the centre has a hole through it, for the reception of the brass socket, B, which has the agate cap fixed in it; the needle is, of course, provided with the usual apparatus for lifting it off the point when not in use, to avoid wearing the point of suspension. *a*, *a*, are two arms, screwed down upon the plate, carrying the vernier, D; they support a brass frame, *b*, which has the usual clamp screw, L, and tangent screw, R, the former to fasten it to the arch, *m*, and the latter to give a slow motion, and adjust the box for the observation.

The transit telescope, O P, is supported over the instrument by two pillars N, N, fixed on the brass plate, E E, and having small frames or boxes, *f* at the top for the reception of the Y's, in which the pivots of the axis, Q, of the telescope are supported; this axis is conical, and is fixed exactly at right angles to the tube, O P, in the same manner as other transit instruments.

On the extremity of one of the pivots of the axis, a small divided circle, R, is fixed, and has an arm at the opposite side turning about on the centre, and provided with verniers to read the divisions on the circle; to this arm a small level, S, is attached; the whole forming a flying index to set the telescope at any required altitude, by setting the index at the proper division, and then moving the telescope till the bubble of the level, S, shows the index to be horizontal; the eye-piece, *h*, of the telescope has a small dovetail in it to admit a dark glass for observation of the sun; *g*, are the screws for adjusting the wires in the eye-piece as usual; the separate figure, TV, is a level to adjust the instrument.

Manner of adjusting the instrument previous to observation.—First place the feet, *k*, *l*, of the level, upon the brass plate EE, in different directions, and bring it level by the screws, H, I, K; then apply the level upon the two pivots of the transit, the covers of the boxes, *f*, opening with hinges for this purpose, and the bottom of the feet, *k*, *l*, have notches to rest upon the pivots; if the axis does not prove level, one of the Y's must be elevated or depressed, by a screw in the farther pillar, N, until the level stands horizontally, and, reversing it end for end, proves every thing to be correct.

Now set the vernier, D, at zero, and put an additional object glass, over the glass, P, of the telescope; and in this state the marks near AA, against which the needle reads, can be seen through it when directed to them; this proves the zero of the division to be exactly in the plane of the telescope motion; a small screw near Q will rectify it, if necessary, by moving the Y a small quantity in the box, *f*; the transit may be reversed in its Y's to rectify every thing.

The telescope is now to be adjusted to the meridian by the transit of the stars in the usual manner, the screws, W, X, being used to turn the whole instrument round when requisite; but after these observations have been once made in a satisfactory manner, distant marks should be set up, both north and south, and these will give the means of adjusting it at once, and in the day time.

When the instrument is properly placed, the taking of the observation is extremely simple. The needle being suffered to settle, the box is turned about on its centre till the mark comes very near the point of the needle; the clamp screw, L, is then fastened, and the screw *k* is employed to make the coincidence exact, in which the microscope, M, greatly assists the eye. The vernier, D, now shows the angle of variation. It is proper, after the needle has been once observed, to attract it with a piece of iron, and cause it to make a slight vibration. When it settles again, it will not in all cases come to the same point, because of the friction of the suspending point; it is therefore advisable to make this trial three or four times, and take the mean of the whole.

The instrument is placed on a pillar, in the open air, free from any iron, and is adjusted before any observation; the vernier is divided to half minutes, and if the meridian be not at a considerable distance, an advantage will be gained by diminishing the aperture of the object glass by a pasteboard cap. I have found the needles should not exceed the weight mentioned, 65½ grains.

It may be worth while to remark, that this instrument will serve as a portable transit instrument for naval officers to examine the rate of their chronometers while on shore.

Colonel Beaufoy afterwards made some changes upon this instrument. The base of it, instead of resting upon a piece of mahogany, was placed on a brass triangular stand, through the angles of which were inserted the mill-headed screws for levelling it. By this improvement the instrument when once levelled retains its horizontal position, the wooden stand being liable to warp. The object glass was also made so as to be capable of adjustment for different distances. One of the needles is a very slender parallellopipedon, and weighs 50 grains. The other is of a cylindrical form, terminating at each end with a cone, and weighs 63 grains. The increase of weight in the needle is owing to the new agates which have been put in.

2. *Variation Transit, as constructed by Dollond.*

The variation transit, represented in Plate DXXIX. Fig. 1, is constructed with the requisite apparatus and adjustments for observing in A R, and when correctly adjusted to the meridian, the needle will show the true variation. For the proof of this, there is a lens fitted into a cap or cover, represented at *a*, which is placed before the object glass of the telescope, whereby it is converted into a transit microscope, the focus of the lens being suited to the distance of the needle, and the divisions of the compass circle; and its centre being made to correspond correctly with the centre of the object glass of the telescope, the collimation of the wires continuing the same. By this method the correct place of the divisions, as well as of the needle, may be readily ascertained, and the extreme as well as the diurnal variation truly determined.

This instrument is also useful for taking altitudes, equal altitudes, and as a theodilite.

3. *Dipping Needle, as constructed by Dollond.*

The dipping needle as represented in fig. 2, is of the plainest construction. Similar instruments are sometimes made with an apparatus for discharging the needle, when used for determining the magnetic force, and for raising and lowering the axis of the needle, with other trifling additions. The instrument here described is furnished with adjustable agate planes for the pivots of the needle to rest upon; and for the purpose of proving the horizontality of these planes, there is a small plate *a* attached to it, the under surface of the plate being ground truly flat, and the level adjusted parallel to that surface.

The needles are shown at 1, 2, 3, 4, 5. The first is upon the plan recommended by Mayer in his Treatise on the Magnetic Dip, and has the centre of gravity at a distance from the centre of motion. This is produced by the small ball at the side. An account of this needle was also published by captain Sabine. The second figure shows the edge of 1 and 3 with the axis in its place. 3 is the plain needle, which at this period appears to be the most approved, as being the least encumbered, and of course the simplest in its use and reductions. 4 was recommended by Dollond upon the principle of doing away any indirect polarity that might be occasioned from the pores of the steel or inequality of magnetising the needle. It is formed with a cube in the middle, from which extends two cones; the cube having two holes at right angles to each other, into which the axis is placed. By this contrivance, each face of the needle may be changed. The theory of this needle is correct, but the use of it is tedious. An account of its performance was published by captain Sabine.

The fifth is the form of needle recommended by captain Kater, which for lightness, and the strength arising from its figure, appears to have given very satisfactory results, where the magnetic power has been feeble. It has been generally used by captain Foster in his experiments.

4. *Diurnal Variation Instrument as constructed by Dollond.*

Fig. 3, is the section of an instrument for determining the diurnal variation of the magnetic needle. It is made of mahogany and ivory, for the purpose of avoiding the attraction that has been suspected in metallic instruments. In this figure, the silk fibre with the needle at its lower end, and the ball or counterpoise at the other end, passed over the pulley, is shown in the middle of the square box between the two microscopes, *a*, *a*; each of these microscopes is furnished with two cross wires; these are brought to correspond with the line on the ends of the needle, by means of the nut, *b*, which also, and at the same time, moves the frame *c*, to which the verniers *d*, *e*, Fig. 4, are attached. These verniers are read off on the arcs *f*, *g*, and give the angle of the diurnal variation. Each end of the needle must be taken to correct excentricity. The needles used with this instrument are represented at Figs 5, and 6; it is also furnished with a piece of brass similar in form, and of the same weight as the needles, for the purpose of detecting the twist of the silk fibre. This instrument may also be used for the horizontal magnetical force, in which case it would require to have a contrivance applied for discharging the needle at the required angle. In general the magnetic force apparatus has been fitted up separately. The diurnal part of the instrument was made by order of the government for captain Foster, who published an account of the variations observed with it, in the Philosophical Transactions. Magnetic force instruments were also furnished by Mr Dollond for his expedition.

5. *Professor Hansteen's Instrument for determining the Magnetic intensity.*

This instrument is represented in Plate DXXIX, Fig. 7. It consists of a well hardened magnetic cylinder of steel, *a*, *b*, about $2\frac{3}{4}$ inches long, and $\frac{3}{40}$ths of an inch thick. The needle is suspended by a fibre *c d*, from the cod of the silk worm in a square box MN made of mahogany. The cover MN of the box consists of three parts, of which the two outermost ones, M, N, have glass windows which may be drawn out. The middle part P is of mahogany, and in the centre of it is screwed a hollow wooden tube T along the axis of which the pipe passes which suspends the cylindrical needle. The box rests on three screws S, S, S, by which it is set horizontally either on a smooth surface or on a tripod stand when it is carried about in travelling. On the bottom of the box a divided arc, or a whole circle graduated on paper, is fixed for the purpose of reading off the oscillations of the cylindrical needle *a b*. The free extremity of the suspending fibre is fixed to a back at T. The needle is drawn out of the magnetic meridian by applying to the end of the box a little iron rod, which being held vertically, has in its lower part a north pole. On removing it the needle begins to oscillate, and when the elongation is 20, the observer determines by means of a chronometer the duration of 300 oscillations, which gives a measure of the magnetic force, as already fully explained in our article MAGNETISM.

6. *Mr Barlow's Correcting Plate.*

When we consider the great quantity of iron which necessarily enters into the construction of a ship and its appendages—with the guns, anchors, &c. we are astonished that the probable disturbance of the needle on ship board from these causes had not long ago led to a full examination of all the circumstances of this action. It appears, however, that the effect itself was only first observed by Mr Wales in one of the voyages of captain Cook, and even then, although the effect was observed, the cause was not looked after—it was merely stated as a curious circumstance, that the needle had a different bearing in different parts of the vessel, and under different courses—the subject at that time therefore attracted little attention. The next reference to the local attraction of vessels, and in which the cause is clearly pointed out, is found in Walker's Treatise on Magnetism, published in 1794. It is contained in a report from Mr Downie, master in H. M. S. Glory, where he says, "I am convinced that the quantity and vicinity of iron in most ships have an effect in attracting the needle; for it is found by experience, that the needle will not always point in the same direction, when placed in different parts of the ship; also it is rarely found that two ships steering the same course by their respective compasses, when compared on board the same ship, will agree exactly with each other."

Soon after this report, the action of the iron of the vessel on the compass was more minutely noticed by captain Flinders, who was the first to trace its connexions with the dip of the needle, and through whose perseverance some attention was paid by the government to the subject, several experiments having been made, by order of the admiralty, on various ships at the Nore, by which the general fact was established. The subject, however, seems to have been again lost sight of, till Mr Bain, a master in the navy, published his valuable little "Treatise on the Variations of the Compass," in which the fatal consequences attending this source of error are so clearly pointed out, as to strike the most indifferent readers. About this time the first of our arctic voyages of discovery was in contemplation, and the local attraction of the vessels was one of the objects to which the attention of the officers was particularly directed by the admiralty.

The results of these experiments are to be found in the accounts of the first voyages of captain Ross, captain Parry, &c. as also by captain Sabine, in the *Phil. Trans.* Part I. 1819, and from which it will be seen, that the amount of error due to this cause in high northern latitudes is such, as to render the needle entirely useless, or worse than useless, in the navigation of those seas.

The existence of a serious evil being thus fully established, the next object was to devise some principle of calculation, or other method, of determining its amount in all cases, in order to its being allowed for in the course of the vessel. Amongst those who engaged in this interesting pursuit, Mr Barlow of the Royal Military Academy, Woolwich, was the most successful. In order to proceed upon some certain grounds, he first undertook a long series of experiments, with a view of reducing the action of iron on a magnetic needle to mathematical laws, and in which he was completely successful. By this means, the local attraction of ships became a matter of calculation, but still, however, requiring as one of the data the dip of the needle, which can never be very accurately known on ship board. The same philosopher, however, at the close of his experiments, fortunately, made another very important discovery, as it related to the subject of his investigation, and, at the same time, highly interesting as a philosophical fact, viz. that the attracting power of iron is not resident in the mass, but on the surface of the iron; so that, in fact, a hollow shell of iron of about 4 lbs. weight, acts as strongly on the needle, at the same distance, as a solid iron ball of 200 lbs. This being established, it occurred at once, that a thin iron plate of 5 lbs. or 6 lbs. weight, might be made to represent and to counteract the whole amount of the attraction of the vessel, and thereby leave the needle perfectly undisturbed; the action of the ship and that of the plate, as regards their action on the needle, neutralizing each other.

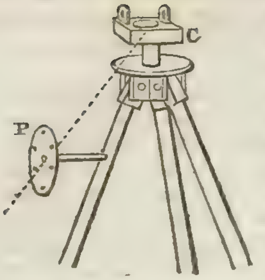
Mr. Barlow having laid his proposition before the Admiralty, orders were given for experiments being made in different parts of the globe,—it having been expected by some, that the laws which had been laid down were of a local kind, and that they would be found to change, like every thing else which had yet been observed of a magnetic needle in different parts of the earth. Those, however, who could appreciate the investigations of the author, felt no doubt on this point.

The correcting plate was accordingly placed under the superintendance of captain Bartholomew and captain Baldy, on the east coast of Africa; under that of captain Basil Hall, in his long and interesting voyage to the western parts of South America; under captain Clavering, in his voyage to Spitzbergen; under captain Lyons, in Hudson's bay; and under sir Edward Parry, in his voyage to Lancaster sound; stretching thus from Lat. 60° S. to Lat. 80° N., and in every case the experiments were found entirely successful. Indeed the success of the plate in the northern voyages went beyond Mr. Barlow's anticipations, it having been found by lieutenant Foster (now captain Foster) that the plate not only corrected the compass, but likewise enabled it to traverse, when without the plate it had lost all its magnetic powers. This happened when the ship's head was to the southward: because in this, the iron drawing the needle southward, while the little remaining powers of the earth drew it northward. These forces destroying each other, the compass became useless; but when the plate was applied, as this neutralized the ship's attraction, that of the earth remained effective, and the compass took up its proper direction.

In the account of sir Edward Parry's voyage in 1825, to Lancaster sound, he says, speaking of this property, "The plate thus placed was now to undergo a severe trial on the ship's arrival in Barrow's straits, and Prince Regent's inlet, where from the extraordinary increase of dip, and the consequently augmented effect of the ship's iron upon the magnetic needle, the compass had before been rendered wholly useless on board ship. Never had an invention a more complete and satisfactory triumph; for, to the last moment of our operations at sea, did the compass indicate the true magnetic direction, requiring of course at times a considerable degree of tapping with the hand merely, to relieve the needle from friction. And even at Port Bowen, where the dip is 88°, and the magnetic intensity acting on a horizontal needle extremely weak in consequence, the azimuth compass on board actually gave the same variation as that observed on shore, within the fair and reasonable limits of error of observation under such circumstances. Such an invention as this, so sound in principle, so easy of application, and so universally beneficial in practice, needs no testimony of mine to establish its merits; but when I consider the many anxious days and sleepless nights which the uselessness of the compass in these seas had formerly occasioned me, I really should esteem it a kind of personal ingratitude to Mr. Barlow, as well as great injustice to so memorable a discovery, not to have stated my opinion of its merits, under circumstances so well calculated to put them to a satisfactory trial."

The principle upon which the action of the plate depends is as simple as its effects are efficacious. If we conceive all the action of the ship's iron to be concentrated in one general focus, we obtain the resultant of all these actions, as in all other cases of compound systems of forces; and it resulted from the experiments made by Mr. Barlow, that this centre would remain constant in all parts of the world, whatever changes might take place in the dip, intensity, and variation of the needle. And hence, if another mass of iron could be placed in a corresponding situation on the opposite side of the needle, another centre of force would be produced, which would counteract the former, and thus leave the needle as free as if no iron were in its vicinity. This, however, would have been impracticable, had it not been for the discovery to which we have alluded, namely, that the magnetic power of iron bodies is resident on the surface only. Availing himself of this property, Mr. Barlow found that by using an iron plate about fourteen inches diameter, he was able to obtain sufficient power to correct the local attraction of any ship in the British navy, although in some the disturbance of the needle from the iron is known to amount to more than a point of the compass, in opposite directions, making an extreme difference of two points or 22°. This takes place in England, where the dip of the needle is about 70°; but as the vessel proceeds to the north, the dip increases, and the deviation amounts, in many cases, to four points, as was the case in the voyage of Sir Edward Parry, above referred to.

The description of the plate is thus given by Mr. Barlow: "It consists of two thin circular plates of iron screwed together, in such a manner as to combine any strong irregular power of one plate with a corresponding weak power of another, by which means a more uniform action is obtained. The iron commonly used is that weighing about three pounds to the square foot; and to prevent any accidental bending, and to give some thickness without much increasing the weight, a thin light piece of board is interposed between them. The method of screwing the two plates is as follows: a central hole is cut in both plates about an inch in diameter, and into this is inserted a brass socket, three inches long, having a broad flanch at one end, and an external screw at the other, with a brass nut; by which means the plates are compressed very strongly in the centre, and they are also held together at their circumference by six small brass nuts and screws. The annexed figure shows the plate attached to the



tripod stand of the azimuth compass; but it is best, instead of the tripod stand, to have a fixed pedestal in any convenient place in the vessel, carrying the compass on its top, with the plate attached to its side.

The plate being thus described, the method of fixing it, and making the experiments, will be best understood from the following directions, supplied by Messrs. W. and T. Gilbert, Leadenhall street, with the plates made by them.

Directions for fixing Barlow's Correcting Plate.

The local attraction of a ship may be found in several different ways, viz. by observations on a distant object, or by reciprocal and simultaneous observations between an observer on board and another on shore, or by one observer on board. In the second case, the distance of the object is of no importance; but in the former, it must be such that the length of the ship and cable shall produce a parallax of only a few minutes of a degree; it ought not, therefore, to be less than six or seven miles.

It should also be observed, that the local attraction of a ship is different in every different point in her, and therefore the observations should be made from some selected spot proper for taking all azimuth and amplitude observations in, during the voyage; and in which spot a compass can remain for conning the vessel, and for correcting the course shown on the binnacle-compasses. In all cases it is necessary at sea, in working a traverse, to know the actual variation; and this being found correctly by means of the plate at the fixed station, it is as easy to allow for the variation and local attraction together on the binnacle-compass, as for variation alone: the errors, therefore, at the binnacle will be corrected by the plate. For example, if after the variation has been determined, it be necessary that the course should be east by compass, and that when the correcting compass shows the course to be east, the binnacle compass shows east-by-north, then east-by-north will be the course to be observed by the man at the wheel,—but the actual course of the vessel will be accounted east. This being premised, the following directions for ascertaining the local attraction of the vessel at the fixed station should be attended to.

To ascertain the Local Attraction by a distant object.

The proper place for using the azimuth and correcting compass being selected by the captain, and a well defined distant object being chosen, the ship moreover being moored or lying with a short scope of cable, with anchors so arranged as to admit of her head being brought to each point of the compass, every thing is ready for observation.

Let the vessel now be brought to any one point of the compass, and steadied there, while the bearing of the distant object is taken and registered. This being done, bring her head to another point, and repeat the observation; do the same at every point, or at least at the north, south, east, west, northeast, northwest, southeast, and southwest, which will be sufficient in most cases.

It will now be found that the bearings thus observed will differ from each other according to the attracting powers of the vessel, from 6° or 8° to 26° or 28°: a difference which is caused by the iron of the ship attracting the needle out of its proper direction,—generally the north end going to the eastward (in these latitudes) with the ship's head towards the east, and to the westward, with the ship's head to the west; but the contrary in southern latitudes, or where the dip is to the southward.[*]

On examining these several bearings, there will be found two at opposite points of the compass (and commonly those made when the ship's head is north and south) that are very nearly the same, the mean of which must be accounted the true magnetic bearing of the object: and the difference between this bearing and the several bearings at the other points, will be the local attraction at each. In general the errors increase both ways, as the ship's head passes from the north and south towards the east and west, and commonly with the ship's head towards

The east,	The southwesterly bearings and the northeasterly	are less	than the truth;
	The northwesterly and southeasterly	are greater	

And with the ship's head towards

The west,	The southwesterly bearings and the northeasterly	are greater	than the truth;
	The northwesterly and southeasterly	are less	

And in marking the local attractions, the four latter cases are denoted by (+), and the former by (—); because in the latter the apparent westerly variation is greater, and the former less, than the true variation.

The following example will in some measure illustrate the above directions.

Observations on the Bearing of a Distant Object in H. M. S. Isabella, *with the view of ascertaining the amount of her Local Attraction.*

Direction of Ship's Head.	Bearing of Object.	Local Attraction.
North	N. 51° 26′ E.	+1° 36′
N. by E.	50 26	+0 36
N.N.E.	49 41	—0 9
N.E. by N.	48 41	—1 9
N.E.	47 51	—1 59

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[*] There are some instances, as in H. M. steam vessel Comet, where the north end of the needle is drawn aft instead of forward, from the effect of the iron chimney, and by being placed too near the iron work abaft.

Table continued.

Direction of Ship's Head.	Bearing of Object.	Local Attraction.
N.E. by E.	46 56	—2 54
E.N.E.	46 26	—3 24
E. by N.	45 56	—3 54
East	45 26	—4 24
E. by S.	44 26	—5 24
E.S.E.	44 26	—5 24
S.E. by E.	44 26	—5 24
S.E.	45 1	—4 49
S.E. by S.	45 36	—4 14
S.S.E.	46 26	—3 24
S. by E.	41 56	—2 54
South	47 56	—1 54
S. by W.	48 26	—1 24
S.S.W.	50 0	+0 13
S.W. by S.	50 26	+0 36
S.W.	51 11	+1 21
S.W. by W.	52 56	+3 6
W.S.W.	53 56	+3 6
W. by S.	54 11	+4 21
West	55 11	+5 21
W. by N.	55 41	+5 51
W.N.W.	55 46	+5 56
N.W. by W.	55 46	+5 56
N.W.	55 11	+5 21
N.W. by N.	54 26	+4 36
N.N.W.	53 26	+3 36
N. by W.	52 26	+2 36

Here the two nearest opposite bearings are at N.N.E. and S.S.W., of which the mean is 49° 50′; this, therefore, is accounted the true bearing,—and the difference between 49° 50′ and the bearing at each point, is the local attraction at each respectively, as registered in the 3d and 6th columns. Also the attraction being nothing, or nearly nothing, with the ship's head at N.N.E., the line of no attraction passes from the compass over the larboard bow, making an angle with the keel of two points, and in this line produced aft the correcting plate is ultimately to be fixed.[*]

To find the Local Attraction by simultaneous Observations on board and on shore.

In this case, the shore station may be taken as near to the vessel as may seem convenient; here a delicate azimuth compass[†] must be placed, and another at the station on board. The ship's head being then brought by warps, &c., as in the last case, steadily to each point, the observer on board registers the bearing of the station on shore, and the observer on shore the bearing of the station on board, at the same time, which, independently of local attraction, ought to be diametrically opposite, so that if one be north 35° east, the other ought to be south 35° west; and when these two bearings do not so agree, the difference shows the local attraction at each point respectively.

To ensure the two observations being made at the same time, when the ship's head is steady upon a point, the ensign, or any other flag proposed for the signal, is dipped or drooped: the observer on shore then keeps the station on board fixed on the line of his sights, and at the moment when the observer on board registers his observation, the flag is hoisted, which is the signal for the shore observer reading and registering his bearing,—both also noting the time by two watches set to each other. This latter precaution is intended to prevent any mistake in comparing the simultaneous observations, which may otherwise happen, by the signal being misunderstood, or not seen [‡]

The following is an example of observations made according to this method, on board H.M.S. Hecla, Captain Parry, May 8th, 1824.

Local Attraction of H.M.S. HECLA.

Direction of Ship's Head.	Bear'g of shore stat'n from ship.	Bearing of ship from shore.	Local Attraction.
North	S. 41° 0′ W.	N. 40° 50′ E.	+0° 10′
N. by E.	42 20	43 54	—1 34
N.N.E.	42 0	45 51	—3 51
N.E. by N.			
N.E.	46 0	50 38	—4 38
N.E. by E.	44 10	50 36	—6 26
E.N.E.	43 10	49 33	—6 23
E. by N.	40 50	47 29	—6 39
East	30 56	43 28	—6 38
E. by S.	34 0	40 59	—6 59
E.S.E.	30 20	37 23	—7 3
S.E. by E.	28 0	33 39	—5 39
S.E.	25 40	30 24	—4 44
S.E. by S.	27 50	31 1	—3 11
S.S.E.	29 40	32 0	—2 20
S. by E.	30 0	31 30	—1 30
South	37 0	36 58	+0 2
S. by W.			
S.S.W.	38 30	34 53	+3 32
S.W. by S.			
S.W.	42 20	36 30	+5 50
S.W. by W.	44 0	38 30	+5 30
W.S.W.	46 10	39 46	+6 24
W. by S.	47 20	40 48	+6 32
West	47 0	41 29	+6 11
W. by N.	49 0	41 10	+7 50
W.N.W.	49 50	42 49	+6 51
N.W. by W.	49 40	42 58	+5 42
N.W.	49 0	43 52	+5 8
N.W. by N.	47 0	43 24	+3 38
N.N.W.	45 30	42 44	+2 46
N. by W.	43 10	41 36	+1 34

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[*] This case (which corresponds nearly with the observations in the Isabella, as given by Captain Sabine) is selected as an example of what sometimes, but very seldom happens, viz. that the line of no attraction lies oblique to the keel of the vessel. In all the ships that I have experimented upon, the line of no attraction is fore and aft.—*P. Barlow.*

[†] The only ship-compass sufficiently delicate for these observations, is the patent azimuth compass, by Messrs. W. and T. Gilbert, 148, Leadenhall street.

[‡] It may sometimes happen, that in vessels with poops, or where the bulwarks are very lofty, the shore station cannot be seen in all positions of the vessel. In this case a second station may be taken on shore, when the first is thus hidden from the observer on board, or the bearing of the sun may be taken by both observers at the same instant; then the difference in these bearings will be the local attraction. In some cases the officers have preferred taking the bearings of the sun; observing also the time, while the ship is swinging to the tide, as her head is passing through N.E., E., S.E., &c. points, and afterwards computing the true azimuths, thus substituting calculations instead of the direct observation above described. This method of course requires no shore station.

Method of fixing the Plate.

The local attraction being determined by either of the above methods, take the mean of the two deviations when the line of no attraction is N.E. and N.W., the mean of the two at east and west, and the mean of the two at S.E. and S.W. In the present case these would be—

Mean at N.E. and N.W.	4° 53′
Do. at E. and W.	6 24
Do. at S.E. and S.W.	5 17

Look for three corresponding or the nearest local attractions in any one line in the following table, filled up with written figures sent with the plate, and opposite to them, in the first two columns, stand the proper depth and distance that the plate is to have with respect to the compass, that is, the first column shows the depth, in inches, the centre of the plate is to be fixed below the pivot of the needle; and the second, the distance it is to be placed from a plumb-line falling from the centre of the needle,—observing always to place it in the line of no attraction, which in the last example, and in the generality of cases, is fore and aft; but in the first example of the Isabella, it is in a line passing from the compass at an angle of two points with the keel of the vessel over the larboard bow.

In this line of no attraction, and at the depth and distance as above described, the plate may be fixed either fore or aft of the compass; but the latter is best, particularly in northern voyages, because when thus situated, it gives considerable freedom to the needle, and causes it to traverse where it would otherwise be useless for want of directive power; and the action of the iron being neutralized by the plate, the bearing of the needle is always correct while the latter is in its place. When it is placed before the compass, the plate is only used occasionally, its attraction is the same as the ship's, but it is in the same direction; by applying it therefore at any time, the amount of the attraction may be ascertained, but it is not neutralized as in the former case. It will of course be understood that the brass conical part sent with the plate is to be screwed upon the pedestal or compass-stand, to serve as a socket for the brass pin which carries the plate; and that when the place for the plate is determined, a hole is to be drilled through the brass pin, to correspond with the hole in the socket, into which a smaller pin is inserted to keep the plate to its place.

We have inserted this table blank; but with any particular plate it is filled up with written figures, as observed from actual experiment on that plate.

Attractions, determined experimentally, of Plate — No. —

Depth of centre of plate below compass.	Distance of plate from plumb-line through centre of compass.	Mean attraction of plate at N.E. and N.W.	Mean attraction of plate at E. and W.	Mean attraction of plate at S.E. and S.W.	Depth of centre of plate below compass.	Distance of plate from plumb-line through centre of compass.	Mean attraction of plate at N.E. and N.W.	Mean attraction of plate at E. and W.	Mean attraction of plate at S.E. and S.W.
11	10				15	13			
11	11				15	14			
11	12				15	15			
11	13				15	16			
11	14				15	17			
11	15								
12	11				16	13			
12	12				16	14			
12	13				16	15			
12	14				16	16			
12	15				16	17			
13	12				17	13			
13	13				17	14			
13	14				17	15			
13	15				17	16			
13	16				17	17			
14	13				18	14			
14	14				18	15			
14	15				18	16			
14	16				18	17			

VARNISH.

VARNISH, is the name of a fluid substance, consisting of a gum or resin dissolved in some fluid, and used by painters, &c. to give an artificial polish to their works. The most common varnishes are, amber varnish, made with amber, drying oil, and oil of turpentine; mastich varnish, made with spirit of turpentine and gum mastich; lac varnish, made of gum lac dissolved in spirit of wine; and gold coloured or lacquer varnish, which is made of gum lac 2 oz., yellow amber 2 oz., dragon's blood 40 grains, half a dram of saffron, and 40 oz. of good spirit of wine.

One of the most useful varnishes is *caoutchouc varnish,* made of caoutchouc dissolved in kyapootee or cajeput oil, or, what is much cheaper, in naphtha prepared from coal tar. Its utility in rendering cloth, leather, &c. waterproof, is very great, and the manufacture of such cloths has been carried to great perfection by our able countryman, Mr. Charles Mackintosh, of Glasgow. The black varnish of the East, the nature of which was long unknown, has been found to be the juice of a large tree, now known by the name of *Melanorrhea usitata*, a new genus established by Dr. Walker. Some of these trees are 40 feet high, with stems 12 feet long, and 11 in girth four feet above the ground. Captain Grant speaks of some as having clear stems of 42 feet to the first branch.

The following interesting account of it is given by Dr. Wallich:*

"As long since as the year 1812, the late Mr. M. R. Smith, for nearly forty years an inhabitant of Sillet, and during the latter part of that long period a zealous contributor to the Honourable Company's botanic garden at Calcutta, furnished some very curious information concerning our tree to Mr. H. Colebrooke, then in charge of that institution. He must therefore be considered as the first person who brought this valuable tree into notice, although he failed in his endeavours to procure either dried specimens or fresh seeds of it. I shall here subjoin some of his remarks.

'I have discovered a sort of varnish, which I consider as the identical one made use of by the Chinese in their eastern and northeastern provinces. It is procurable, in great quantities, from Munipur, where it is used for paying river crafts, and for varnishing vessels destined to contain liquids, such as oil, ghee (clarified butter), milk, honey, or water. The drug is conveyed to Sillet for sale, by the merchants, who come down annually with horses and other objects of trade. The tree which yields it grows to an amazing size. I am informed that it attains one hundred cubits in height, and twenty in circumference, and even more. It forms extensive forests, which commence at a distance of three days' journey from the capital, and stretch in a northerly and easterly direction towards China for many miles.' "

That the *Kheu* which Mr Smith describes is the same as that found by captain Grant, there cannot be any doubt; nor that it is identical with the *Theet-tsee*, or Varnish-tree of the Burmese. It follows, hence, that the tree has a very wide geographical range, extending from Munipur (in latitude 25° N. and longitude 94° E.) to Tavoy (in latitude 14°, longitude 97°). The valley of Kubbu, which has been ascertained by actual survey, made by lieutenant Pemberton, to be only five hundred feet above the plains of India, is distant two hundred miles from the nearest sea shore. The tree there attains its greatest size, and I believe it becomes smaller as it approaches the sea on the coast of Tenasserim, where it grows in comparatively low situations.

Our tree belongs to the Deciduous class, shedding its leaves in November, and continuing naked until the month of May, during which period it produces its flowers and fruit. During the rainy season, which lasts for five months, from the middle of May until the end of October, it is in full foliage. Every part of it abounds in a thick and viscid greyish-brown fluid, which turns black soon after coming in contact with the external air. In *Dr. Brewster's Journal of Science*, vol. viii, page 96 and 100, there are two interesting articles, containing valuable information concerning the varnish produced by our tree, and its deleterious effects on the human frame. It is a curious fact, that, to my certain knowledge, the natives of the countries where the tree is indigenous, never experience any injurious consequences from handling its juices: it is strangers only that are sometimes affected by it, especially Europeans. Both Mr Swinton and myself have frequently exposed our hands to it without any serious injury. I have even ventured to taste it, both in its recent state and as it is exposed for sale at Rangoon, and have never been affected by it. It possesses very little pungency, and is entirely without smell. I know, however, of instances where it has produced extensive erysipelatous swellings, attended with pain and fever, but not of long duration. Of this description was the effect it had on the late Mr Carey, a son of the Rev. Dr. W. Carey, who resided several years in the Burma empire. Among the people who accompanied me to Ava, both Hindoos and Mahomedans, no accident happened, although they frequently touched the varnish, except in a slight degree to one of my assistants, whose hand swelled and continued painful during two days. Dr Brewster informs me that, after resisting its effects for a long time, it at length attacked him in the wrist with such violence that the pain was almost intolerable. It was more acute than that of a severe burn, and the Doctor was obliged to sleep several nights with his hand immersed in the coldest water. He considers it as a very dangerous drug to handle. One of his servants was twice nearly killed by it.

In the neighbourhood of Prome a considerable quantity of varnish is extracted from the tree; but very little is obtained at Martaban, owing, as I am told, to the poverty of the soil, and partly also to the circumstance of there being none of the people in that part whose business it is to perform the process. This latter is very simple: short joints of a thin sort of bamboo, sharpened at one end like a writing-pen, and shut up at the other, are inserted in a slanting direction into wounds, made through the bark of a trunk and principal boughs, and left there for twenty-four and forty-eight hours, after which they are removed, and their contents, which rarely exceed a quarter of an ounce, emptied into a basket made of bamboo or rattan previously varnished over. As many as a hundred bamboos are sometimes seen sticking into a single trunk during the collecting season, which lasts as long as the tree is destitute of leaves, namely, from January until April; and they are renewed as long as the juice will flow. A good tree is reckoned to produce from one and a half to two, three, and even four viss annually, a viss being equal to about 3¼ lbs. avoirdupois. In its pure state it is sold at Prome at the rate of one tical, or 2*s.* 6*d.* the viss. At Martaban, where every thing was dear when I was there, the drug was retailed at two Madras rupees per viss; it was of an inferior quality, and mixed with sesamum oil; an adulteration which is often practised.

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* See Dr. Brewster's *Journal of Science*, No. III. p. 66, New Series, which contains the whole of this valuable paper.

The extensive use to which this varnish is applied, indicates that it must be a very cheap commodity. Almost every article of household furniture destined to contain either solid or liquid food is lacquered by means of it. At a village close to Pagam on the Irawaddi, called Gnaunee, where this sort of manufacture is carried on very extensively and to great perfection, I endeavoured to obtain some information relating to the precise mode of lacquering; but I could learn nothing further than this,—that the article to be varnished must first be prepared with a coating of pounded calcined bones; after which the varnish is laid on thinly, either in its pure state or variously coloured by means of red or other pigments. I was told that the most essential as well as difficult part of the operation consists in the process of drying, which must be effected in a very slow and gradual manner; for which purpose the articles are placed in damp and cool subterraneous vaults, where they are kept for several months until the varnish has become perfectly dry. Another object for which the drug is extensively employed, is as a size or glue in the process of gilding; nothing more being required than to besmear the surface thinly with the varnish, and then immediately to apply the gold leaf. If it is considered how very extensively that art is practised by the Burma nation, it being among their most frequent acts of devotion and piety to contribute to the gilding of their numerous religious edifices and idols, it will be evident that a great quantity of the drug must be consumed for that purpose alone. Finally, the beautiful Pali writing of the religious order of the Burmas on ivory, palm-leaves, or metal, is entirely done with this varnish, in its native and pure state."

A full account of Varnishes will be found in our article Japanning, written for this work by Mr John Farey, Vol. XI. p. 53, 54. See Caoutchouc, Vol. V. p. 291, and Chemistry, Vol. V. p. 766.

On Japanning and Varnishing.—It has been a great desideratum among artists to render shellac colourless, as, with the exception of its dark brown hue, it possesses all the properties essential to a good spirit varnish, in a higher degree than either of the other resins. A premium of a gold medal, or thirty guineas, "for a varnish made from shell, or seed lac, equally hard, and as fit for use in the arts, as that at present prepared from the above substances, but deprived of its colouring matter," has long been, and is still offered, by the Society, in London, for the encouragement of Arts, Manufactures, and Commerce. These ends are perfectly attained by the process given by Dr. Hare, which leaves nothing to desire, excepting on the score of economy. Were the oxymuriate of potash to be manufactured in the large way, the two processes, that of making the salt, and of bleaching the resin, might be very advantageously combined.

Method of bleaching shell, or seed lac. By R. Hare, M.D.—Dissolve, in an iron kettle, one part of pearlash in about eight parts of water, add one part of shell, or seed lac, and heat the whole to ebullition. When the lac is dissolved, cool the solution, and impregnate it with chlorine till the lac is all precipitated.

The precipitate is white, but its colour deepens by washing and consolidation; dissolved in alcohol, lac, bleached by the process above mentioned, yields a varnish which is as free from colour as any copal varnish.

Chlorine, or oxymuriatic acid, may be formed by mixing intimately eight parts of common salt, and three of the black oxyde of manganese, in powder. This mixture is to be put into a retort; four parts of sulphuric acid, diluted with an equal weight of water, and afterwards allowed to cool, is to be poured upon the salt and manganese, when the gas will immediately be liberated, and the operation must be quickened by a moderate heat. If the mixture be made without the sulphuric acid, and this be added in small portions, the heat generated by this means will be sufficient to disengage the gas, without the aid of a lamp. A tube leading from the mouth of the retort, must be passed into the resinous solution, when the gas will be absorbed, and the lac precipitated.

On the preparation and use of a Mastic Varnish, particularly suitable for paintings in oil. By Joshua Shaw, Esq.—Amateurs and collectors of paintings are frequently at a loss for a varnish properly prepared and suited for the purpose of restoring and preserving the colours in works of art. I submit the following observations on the preparation of a very good one, and the best mode of applying it to the surface of pictures painted in oil.

Experience has shown that, for this purpose, mastic varnish is in general preferable to any other, especially in the hands of inexperienced persons, and, with but few exceptions, even in those of the adept. This varnish is generally prepared by dissolving the mastic in spirits of turpentine, over a sand heat, in a well glazed earthen, or in a copper vessel, occasionally shaking or stirring it about until entirely dissolved, which will take place before it arrives at a boiling heat; after which it is strained through a piece of calico, in preference to linen, as it is less apt to give off lint, which is very troublesome when it gets into the varnish: it is then put into a bottle, well corked, and placed for two or three weeks where the light of the sun can strike it, which will cause a large precipitation of mucilaginous matter, and render it as transparent as water. It is now to be decanted off into a clean bottle, and put by for use. This is the mode of preparing that commonly sold in the shops; but to insure a varnish that can be depended upon, the following observations must be attended to. Let all the mastic be bruised by a muller on a painter's grinding stone, which will immediately detect the soft or oily tears, which must be rejected; as when dissolved in the mass they prevent the varnish from drying hard, leaving a greasy or tacky surface. The next point of importance is, to procure, if possible, turpentine which has been distilled a second time; but where this is not to be had, the best kind sold in the shops must be taken; but it must be perfectly clear and colourless, otherwise good varnish cannot be obtained: it must not be furnished through an oily measure, (which is but too commonly the practice) but poured out of the carboy without shaking or disturbing it. If any doubts are entertained as to its purity, put about two tablespoonfuls into a common white saucer, and let it evaporate in the sun, which will be effected in two or three hours; and if it leave a greasy residuum or a soft sticky mucus it must be rejected; that only is good which entirely disappears. Thus prepared with good spirits of turpentine, and with mastic bruised and picked, the two ingredients may be put into a clean bottle, when the resin may be dissolved without heat, by half an hour's shaking in the hand; it must then be strained, and afterwards treated as before recommended.

The French sometimes prepare this gum in spirits of wine (pure alcohol), but it is subject to chill on the picture, and produces, in a time, a kind of white scale over it, which injures its lustre.

When it is prepared after the manner recommended, six ounces of pounded gum are mixed with fourteen ounces of pure spirit of turpentine, which may, if found too thick, be diluted with more turpentine. It should be laid on with a soft, flat, camel's hair brush, as it is called, but which, however, is made of the hair obtained from the squirrel's tail. The varnish should always be laid on with as much despatch as possible, keeping it alive, as the artists term it, and floating after the brush. It may be proper to observe, that no kind of varnish should be applied to any painting, without first cleaning it; nor to a newly painted picture until it is perfectly hard, to effect which requires five or six months. Before varnishing, be careful to remove all grease from the surface by a coat of whiting, (not lime) dissolved in water, and laid on so that it covers and entirely obscures the picture; this should be allowed to dry, and to remain on for one or two hours, when it must be entirely removed by a sponge and some clean rain water; then perform the operation of varnishing in a still room, free from lint and dust.

It will sometimes happen that a picture, where the surface is smooth, will look too bright and glaring, which is both disagreeable to the eye, and injurious to the effect of the picture: to remedy this defect, after the varnish is quite dry, say in ten or fifteen days, sponge the picture all over with pure rain water, for about one or two minutes; and having squeezed the sponge, and made the picture as dry as the sponge will leave it, pass lightly a clean silk handkerchief over it, with great rapidity, until it becomes perfectly dry; when a clear, steady, lucid appearance will pervade the whole picture. Breathing occasionally on the picture to damp it, will assist the operation, while chafing it with the handkerchief.—*Franklin Journal.*

Copal Varnish. By J. J. Berzelius.—Copal reduced to coarse powder, and watered with caustic liquid ammonia, swells, and is converted into a gelatinous mass, which is entirely soluble in alcohol. To effect this solution, which makes a very beautiful varnish, liquid ammonia is to be added, by degrees, to pulverized copal, till the swelling ceases, and it becomes a clear and consistent mass. It is then heated to 35° cent., and introduced in small portions at a time, to alcohol of 8, having a temperature of about 5° cent., shaking it well after each addition. A solution is thus obtained, which, after depositing an insignificant portion of sediment is absolutely colourless, and as clear as water.

Journ. de Con. Usuelles, Oct. 1828.

VAUCLUSE, the name of a department in the south-east of France, contains about 336,963 hectares, or nearly 1400 square miles. The north-eastern part is traversed by branches of the Alps, some of which, as Monts Ventoux, Lure, &c. have a considerable height. A broad valley along the Rhone occupies the west of it. The rivers are the Rhone, the Durance, and the Sorgens, which is formed by the celebrated fountain of Vaucluse, which issues from an immense cavern encircled with rocks and mountains.* The soil in the low grounds is rich, but the pasturage is poor. Silk, linen, and leather are the principal manufactures. The department is divided into four arrondissements, that of Avignon, the capital, Orange, Carpentras, and Apt. The population in 1822, was 224,431, and in 1827, 233,048.

VEGETABLE PHYSIOLOGY. See BOTANY, Vol. IV. Part II. p. 42—68.

VELASQUEZ DE SILVA DON DIEGO, a celebrated painter, was born at Seville in 1594, and died in 1660. See our article PAINTING, Vol. XV.

VENDEE, LA, a department in the west of France, contains 675,458 hectares, or about 2600 square miles. Its surface, which is almost entirely level, is divided into three parts, called wood, marsh, and plain. The part called the wood is fertile in corn, wine, and pasture. The marsh near the coast has been made highly productive. The plain is fertile. The rivers are the two Sevres, the Vendee, and the Autise. It is also intersected with canals and ditches. Corn, cattle, salt, wool and hides, are the principal exports. It is divided into three arrondissements, Bourbon Vendée, the capital, Sables d'Olonne, and Fontenay. Population in 1822, 316,587, and in 1827, 322,826. A notice of the civil war in La Vendée is given under FRANCE, Vol. IX.

VENEZUELA. See CARACCAS, Vol. V. 318—331.

VENEERING, OR FINEERING, is the art of inlaying common wood with thin slices of fine and rare woods. This art has been brought to great perfection by our celebrated engineer M. Brunel. He at first contrived a machine by which the thin slices of wood were cut from the mass, without any loss, and rolled up into scrolls. The London cabinet-makers did not consider the slices thus cut as sufficiently strong, in consequence of the effect produced by being rolled up. This, however, was a mistake, for the glue got into the numerous crevices or minute joints of the wood, and held it much firmer than if it had been applied only to a surface. We have seen very handsome veneered furniture with which the veneers were cut by this machine of Brunel's.

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* See France, Vol. IX.

M. Brunel then constructed two great circular saws eight feet in diameter, by which he sawed the veneers to a great degree of thinness, and has thus given a new degree of perfection to the art of veneering.

VENICE, a city in the north-east of Italy, is built on from 60 to 138 small islands near the northern extremity of the Adriatic Sea or Gulf of Venice. The town is separated from the main land by a marshy lake five Italian miles broad, and from three to six feet deep. The city is said to be a little more than two miles long, one and a half broad, and six in circumference. It is divided into two nearly equal parts by a great canal about 1200 yards long, and 100 feet wide, which winds through it, and is crossed by the celebrated bridge of the Rialto, of a single arch. Many other canals intersect the city, and these are crossed by from 450 to 500 bridges, most of which are of stone. The inhabitants are conveyed through the city in gondolas, and by means of small boats. Merchandize is deposited at the very doors of the warehouse. The quarter north of the great canal is divided into three, namely, the Sestiere de Castello, the Sestiere de San Marco, and the Sestiere de Canareggio. The quarter to the south of the great canal is divided into the Sestiere de St. Paolo, de St. Croce, and de Dorso Duro.

The streets in Venice are in general only from four to six feet wide, with the exception of that of Merceiria, which contains shops of every kind, and which is from 12 to 20 feet wide. The only square in Venice is the Piazzi de San Marco, an irregular quadrangle, 280 feet long and 100 broad, and containing several handsome buildings. The south range of buildings called the *Procuratie Nuovo*, was begun in the year 1587, and occupied by the *Procuratore di San Marco*, officers next in dignity to the doge. It is now the residence of the Austrian governor, and contains some of the public offices. The west side was built by the French after the revolution, and contains the grand entrance of state and ball room, erected on the site of the church of St. Genevieve, which Bonaparte ordered to be pulled down for that purpose. The north side of the square, called the *Procuratie Vecchie*, is older than the rest, and is inhabited by private individuals. A continued arcade runs round three sides of the square, containing coffee-houses and all kinds of shops. The principal entrance to the square is on the north side under the *Clock Tower*. This tower has a fine astronomical clock, and is terminated with a bell and two colossal bronze figures, which strike the hours and quarters. The east side of the square is terminated by the celebrated church of St. Mark, and a small square called the Place of Flowers. The pavement of this square is elevated in the centre to protect a well for supplying the city with rain water. In front are two lions sculptured in beautiful red marble from the island of Zea, and placed here in commemoration of a plot to destroy the Republic. The conspirators met in this square, and a woman running hastily to the window to see what was going on, overturned a flower-pot which struck the ringleader Tripolo on the head and killed him on the spot. Regarding this as an act of divine vengeance the conspirators fled.

Opposite the church of St. Mark are three lofty flag-staffs raised on finely wrought bronze vases. They were placed there to commemorate the conquest of the Morea, Epirus and Candia, and the flags of these countries were in the days of the republic hoisted upon them during the public festivals. The *Piazetta* is an open space extending from St. Marks to the sea. On the east side of it is the ducal palace, or that of the doge, an extensive Gothic building, with many splendid apartments and fine paintings. The offices of police are in this building, and the Austrian main-guard is stationed in that part of it called the Broglio. Opposite to the ducal palace is the public library, an elegant building of one story, elevated upon an arcade, and ornamented with white marble statues on the parapet. Behind this building is the Zecca or mint, which fronts the water. The two grand columns at the end of the Piazetta, next the sea, are of Egyptian granite, and were brought from Greece about 1206. A third fell into the water and was lost. On one column stands a winged lion in bronze, and on the other a bronze statue of St. Theodore standing upon a crocodile. The lion was removed by the French and placed upon the Hotel des Invalides at Paris, but it was restored to Venice at the general peace. In the time of the republic criminals were executed between these pillars.

The church of St. Mark, once only the church of the palace, is now the principal one in the city. It was begun in 829, but being burnt down was rebuilt in 976. The interior is entirely covered with Mosaic pictures in stained glass on a gold ground, which are reckoned inferior only to those of St. Peter's at Rome. The altars and columns are of the richest marble, and likewise the tesselated pavement. The centre front consists of 10 arches, five above and five below, the lower ones being supported by two rows of columns, 292 in number, some being of porphyry, others of verd antique, and the rest of fine marble, all of them trophies of the Venetian conquests. The upper centre arch is terminated by a colossal statue of St. Mark, and above the lower one are placed the celebrated Grecian horses of Corinthian brass, said to be the work of Lysippus. These horses are supposed to have stood successively on the triumphal arches of Augustus, Domitian, Trajan, and Constantine, the latter of whom removed them, with the chariot of the sun, and placed them in the Hippodrome. In 1206, when the Venetians took the city, they carried them to Venice, where they stood above the grand entrance to St. Mark 600 years. The French took them to Paris in 1797, and placed them on the triumphal arch in the place de Carousel; but they were returned to their rightful owners in 1815.

The Campienello, or bell tower, stands opposite to the church. It is 300 feet high. The ascent to the bells is by inclined planes, and from the gallery there is one of the grandest views in Venice. At the base of the Campienello is the Logetta, a small, though beautiful marble building.

The houses in Venice are generally gloomy and defective in accommodation. Ordinary buildings are of brick covered with wood, and the general height is three or four stories. The principal mansions of the great families are the palaces of the Balbi, Canaro, Barbarigo, Grassi, Farsetti, &c. One of the principle churches beside that of St. Mark, is that of St. Maria della Salute, designed by Palladio, and built wholly of marble. It contains several fine pictures by Titian; that of Il Redemptore, in the island of Giudecca, is very elegant. The cathedral of St. Peter stands on an island at the east end of the city, and is built of Istrian marble. The church of St. Georgia Maggiore, in the island of the same name, is the work of Palladio, and is one of the most beautiful in Venice. The church of S. S. Giovanni e Paolo is the Westminster Abbey of Venice, and contains the tombs of its great men. It is a large Gothic structure, and contains the martyrdom of St. Peter by Titian, which was carried off to the Louvre, but was replaced in 1815. Near this church is a fine building with elegant halls, called the school of St. Mark, opposite to which is a bronze equestrian statue of *de Bergamo*, the Venetian general. Venice has eight theatres, the newest and most elegant of which is the *La Fenice.* The assembly rooms contiguous to it are large and handsome. The arsenal is a magnificent building, situated on an island near the eastern end of the city. It is defended by a rampart, and before its gates are two huge pillars, with the two gigantic lions in granite which once stood on the Piræus at Athens.

The trade of Venice was at its height in the 12th, 13th and 14th centuries, but even then it probably did not exceed that of Liverpool. Though enormously diminished, it is still considerable, particularly with the Levant, the produce of which it transmits to other countries, while it supplies the Levant with groceries, Dutch and German linens, &c. dried and salted fish, &c. The manufactures of Venice consist of woollens, serges, canvas and ropes, velvets, gold and silver embroideries, silk stockings, and lace. The mirrors and turpentine of Venice are celebrated every where. Printing is carried on to a considerable extent.

There is at Venice an academy of the fine arts, an athenæum, and an academy for general education, a school of navigation, and an establishment like a foundling hospital, called the *Rio de Pieta*, for educating in all kinds of employments *one hundred* young women. Music has always been the principal study; on Sundays they give concerts in their church, when the girls sing and play upon every kind of instrument. On the small island of Lazarus there is an Armenian seminary, with a large library and printing office where a newspaper is published.

The chief promenades are the square of St. Mark; the gardens and the convent of St. Georgio Maggiore, the New Quay and the garden of the Countess de Savorgnan.

The history of Venice has been sufficiently noticed in that of the other states of Europe. It is now under the dominion of Austria, by whom it is treated with great indulgence. Population about 120,000. Lon. of St. Mark 12° 20′ 59″ E. North Lat. 5° 25′ 32″. See Kuttner's *Travels*, chap. xxiv.; Eustace's *Travels*, vol. ii. p. 67; Mayer's *Beschreebung von Venedig*. Leipz. 1790, and Arndt's *Travels*, tom. 1.

VENTILATION OF MINES. See MINES, Vol. XIV. p. 386—399.

VENTRILOQUISM, See ACOUSTICS, Vol. I. p. 179, SCIENCE, *Curiosities in*, Vol. XVI. p. 592, Edinburgh *Journal of Science*, No. XVIII. p, 241, 252, and Stewart's *Philosophy of the Human Mind*, vol. iii. p. 229.

VENUS. See ASTRONOMY, *Index*.

VERA CRUZ, PROVINCE OF. See MEXICO, Vol. XIII. p. 193.

VERA CRUZ, the great sea-port town of Mexico, is a beautiful city regularly built, and with straight and spacious streets. It stands on a parched plain, covered with hills of sand from 30 to 40 feet high, which are constantly changing their position. The town is encircled with a parapet wall surmounted with a wooden pallisade. All the houses are built with materials drawn from the bottom of the sea. Water is obtained by digging nine or ten feet into the sand, but as it is very bad, an aqueduct was begun and carried on at great expense, but has not yet been completed.

The harbour, which is not commodious, is defended by two redoubts. At the distance of 800 yards, is an islet with the fortified castle of St. Juan D'Ulloa, containing 300 pieces of cannon. About 50 ships of war, or 100 merchant vessels might anchor here in from four to ten fathoms of water.

An account of the trade, &c. of Vera Cruz has already been fully given in our article MEXICO, Vol. XIII. p. 193, &c. Population 16,000. W. Lon. 100° 49′ 15″, N. Lat. 19° 11′ 52″.

VERDE, ISLANDS AND CAPE. Cape Verde is a considerable cape stretching into the Atlantic, and forming the most western point of Africa. It gives name to the Cape Verde islands, which are ten in number, three large ones, St. Jago, St. Antonio, and St. Nicholas, and seven small ones, viz. Mayo, Bona Vista, Sal, St. Vincent, St. Lucia, Brava, and Fogo. These islands are very imperfectly known. They are said to consist chiefly of volcanic matter, and the island of Fogo contains an active volcano. The governor general resides in Jago at Port Praya. Mayo is celebrated for its sea-salt. St. Vincent, which is thirty miles in circuit, is uninhabited. The Portuguese inhabitants are very few and very poor, and the negro and mulatto slaves are to a considerable degree independent. See BONAVISTA, Vol. III. p. 653.

VERDEN, a province of Hanover, containing 520 square miles, and a population of 23,000, all Lutherans. The chief town, Verden, is a small place with almost no manufactures, and a population of 3000.

VERMES. See ZOOPHYTOLOGY, in this volume.

VERMONT.

VERMONT, one of the north-eastern states of the United States, bounded on the east by New Hampshire; on the south by Massachusetts; on the west by a part of New York, and thence by Lake Champlain, and on the north by Lower Canada,

Having an outline along Connecticut river opposite to New Hampshire, without estimating the partial bends of the stream, - - - - -	170	miles.
Boundary in common with Massachusetts, - - - - - - -	43	do.
Do. in common with New York, and along Lake Champlain, - -	160	do.
Boundary on the north in common with Lower Canada, - - - - -	90	do.
Entire outline, - - -	463	

This state extends in Lat. from 42° 44′ at the south-eastern angle to 45°, or through 136 minutes of Lat. or within an inconsiderable fraction of 157 statute miles. Measured carefully on the best maps the area is rather above than below 8600 square miles; the mean breadth will consequently be about 55 miles.

Though not so represented on most maps of that state, there are two distinct chains of mountains which traverse it in its greatest length. These chains were noticed under the head of mountains, and were there shown to be the continuation of the Blue Ridge and South-east mountains. The mountains of Vermont received their French name from the dense forests of evergreen laurel and terebinthine trees which clothe their slopes, valleys, and most of their summits. The name was extended to the country, and is rendered permanent by being given to the state.

By reference to Table XV. Art. United States, or the route of the Massachusetts and Hudson rail-road, the elevation of the two mountain chains are given before their entrance into Vermont. These chains rather rise than depress in leaving Massachusetts. If, however, we examine Vermont as a physical section, from the sources and respective slope of its river valleys, we find the state composed of two inclined plains, but of very unequal breadth and rapidity of descent. The bases of these plains are the Connecticut river on the east, and Lake Champlain on the west. By turning to Table XVI. Art. United States, it will be seen, that the surface of Lake Champlain is only 90½ feet above the ocean tides; and by Table XVII, Art. United States, if we compare the elevation of Connecticut river, 73 feet at the influx of Miller's river, with the general rise of that river channel, we shall find that the south-eastern angle of Vermont is very nearly of equal elevation with its north-western border on Lake Champlain. But the Connecticut channel rises so much as to be 1028 feet above the ocean level at Canaan in Essex county, near the extreme north-eastern angle of Vermont. From these elements, it is evident that the arable surface of that state along its northern border, has a general declivity of about 1000 feet in 90 miles, equal to 11⅑ feet per mile. This conjugate declivity is very unequally distributed. The state is divided into sub-valleys, which, to expose with more precision, we survey from south to north.

The south-western angle of the state, commensurate with the county of Bennington, gives source to Batten Kill and Hoosack rivers, which flow westward into the Hudson river; and also, in its northern part, to the extreme sources of Paulet and Otter rivers, flowing N.N.W. into Lake Champlain.

Otter entirely overheads Paulet, the former rising on the central valley between the two main chains, and flowing northwards, between them, to about half its course, breaks through the western, and, inclining to N.N.W., falls into Lake Champlain, after a comparative course of 70 miles. The Otter river is followed, on the same plain, by three other confluents of Lake Champlain—Onion, La Moelle, and Mississque rivers. Onion and La Moelle, something more brief than Otter in length of course, rise also in the slopes and vales of the eastern chain, and traverse the western, in their way to their final recipient. To the sources of the Otter, Onion, and La Moelle, are opposed the more brief streams that fall into Connecticut river. Of these Deerfield river, though rising in Vermont, flows southwardly into Massachusetts, and in the latter bends to the eastward, and meets its recipient at the bottom of the great bend below the mouth of Miller's river. With courses generally to the south-east, beside innumerable creeks, are to the northward from Deerfield, West, Black, Waterquechy, White, Watts, and Wells rivers. All these named flowing from the eastern Vermont chain, and fall into Connecticut river below the mouth of Passumpsic. At the latter point, the western slope of the Connecticut basin is so narrow, that it is not above twelve direct miles to the extreme sources of either Onion or La Moelle rivers. The western slope of Connecticut widens with the Passumpsic, but again narrows to not above six miles at the extreme north-eastern angle of Vermont. The peculiar structure of the Passumpsic valley, and its connexion with the Memphramagog valley, may be seen by reference to the head of Connecticut basin, and Table XVII., article United States.

Lake Memphramagog, with its numerous confluents, may, in some respects, be regarded as an anomaly in the geography of Vermont. The lake itself, extending to 25 miles in length, with a mean width of perhaps two miles, and with about one-third of its length in Vermont, receives its confluents from each chain, and is, with these tributaries, part of the drains of the central mountain valley, but, declining northwardly, bears its water into St. Lawrence by the St. Francis. See Table XVII., article United States. Lake Memphramagog, distant 40 miles from Champlain, is 562 feet more elevated.

From the preceding elements, with the exception of the comparatively small section drained into Lake Memphramagog, and which slopes northwardly, the great body of Vermont is composed of two inclined plains, having the eastern chain of its mountains as a common apex, and the channel of Connecticut as its eastern and most elevated base, and the shores of Lake Champlain as the western and most depressed base. Through this main chain, the summit level between Passumpsic sources and those of Lake Memphramagog are 1175 feet above the Atlantic tides, and that between Onion and White rivers is about 850 feet, of similar relative elevation. Independent, therefore, of the geographic position of its natural sections, the mean and extreme temperature of Vermont must differ greatly, following the rapid change of height. The elevations given are taken from measurements made with canalling projects in view, taken, of course, along the streams, and over the lowest gaps of the mountains, of consequence, in every case of the streams, below the arable country adjacent. The cultivated soil differs in height above the ocean from 100 to, it is probable, 1500 feet, or to an amount exceeding an equivalent to three degrees of latitude.

The soil of Vermont is as various as its surface, but a large proportion productive. The soil and climate are more suitable to grasses than to fruit, though of the latter the apple in particular succeeds well. Of minerals, iron ore is the only one of value that is abundant.

The opening of the Hudson and Champlain canal was of inestimable advantage to western Vermont. Having an inland sea extending about one hundred miles along its western border, and into which the canal entered, more than one-half the state was opened to tide navigation, which was before in a peculiar manner secluded. Pot and pearl ashes, the product of immense forests, and even the timber of those forests, now find a ready market. Consulting the tables of relative height in the article United States, will disclose the fact, that 90½ feet of lockage is only necessary to open the tide navigation of St. Lawrence to Lake Champlain. The subjoined tables will exhibit how much the advance of population in Vermont has depended on commercial facility.

Political Geography.—From the abstract of the respective enumerations of the people of the United States, taken in 1790, 1800, 1810, and 1820, published by the United States general government, with the result of the census of 1830, we find that it was not until the census of 1820 was taken that the counties of Vermont were complete, as they stand in that of 1830. We have therefore constructed the general table so as to include only the two last enumerations, as by them alone can be made any beneficial statistical comparison.

TABLE

Of the Distributive Population and Extent of Vermont by Counties:—the Population according to the Census of 1820, *a that of* 1830. *The number of Post Offices in each County, from the Post Office List, published at the General Post fice, Washington City,* 1831.

County.	Natural Position and General Features.	Square Miles.	Population, 1820.	Population, 1830.	Pop. to Sq. Mile, 1830.	No.Po. fices,18
Windham,	The south-eastern county of the state, in the basin of Connecticut, and drained by the rivers, Deerfield, Greene, West, Sexton's, and Williams. General slope south-eastward, -	710	28,457	28,748	40	20
Windsor,	To the north of the preceding, and in the Connecticut basin: drained by the rivers Williams, Black, Waterqueechy, and White rivers. The latter much the most considerable of its streams. General slope south-eastward, - - -	820	38,233	40,625	49½	36
Orange,	Northwardly from Windsor, and in the Connecticut basin. The southern side slopes to the southward and is drained by the northern sources of White river, and by Thetford river. The northern part slopes south-eastward and is drained by Watts's river, - - - - - - - - - -	680	24,681	27,285	40	26
Caledonia,	Extending up the Connecticut and Passumpsic rivers above Orange, but the middle part extending westward into the basin of Champlain. The southern section is on the narrow western slope of the Connecticut basin, where the sources of Onion river rise within 12 miles from the channel of Connecticut. The northern part is divided into two sections by the eastern chain of Vermont mountains. The eastern and largest of these northern sections is occupied by Passumpsic valley: the western gives source to both Onion and La Moelle rivers. General slope of the eastern part in the valley of Passumpsic to the southward; the southern section falls					

Table Continued.

County.	Natural Position and General Features.	Square Miles.	Population, 1820.	Population, 1830.	Pop. to Sq. Mile, 1830.	No. Po. Offices, 1831.
	eastward towards Connecticut river; whilst the western part in the valley of La Moelle declines to the westward, -	560	16,689	20,967	37⅓	22
sex,	This is the north-eastern county of the state, extending about 50 miles along Connecticut river, with the general slope to the east towards that stream. The south-western part, however, gives source to Passumpsic; from the western issues Clyde river, a confluent of Lake Memphramagog, and from the northern flows some of the higher tributaries of St. Francis. Two canals or rail-roads have been projected to pass over this county; one by the Willoughby and Passumpsic, and the other by the Clyde and Nulhegan rivers, -	770	3,284	3,981	5⅓	8
nnington,	Is the south-western county of Vermont. The general slope is westward, giving source to Hoosack, Batten Kill, and Paulet rivers. The extreme western sources of Deerfield and West rivers rise in this county; it is therefore a table land in part between the basins of Hudson and Connecticut, - -	680	16,125	17,468	25½	18
tland,	Lies north from Bennington, and west of Windsor and of the main chain of the Vermont mountains. It is traversed by the western chain; and the western part, drained by Paulet and Poultney rivers, falls westward towards the head of Lake Champlain. The eastern part between the two mountain chains, has a northern declivity drained by Otter river, which stream breaks through the western chain on the northern border of the county, - - - - - - - - -	820	29,983	31,294	38	26
ldison,	North from Rutland, and extending along Lake Champlain, has a declivity a very little west of north, drained in most part by Otter river. The eastern part, however, extends into the central valley, and from which issue the extreme western sources of White river, - - - - - - -	530	20,469	24,940	47	20
ittenden,	Follows Addison along Lake Champlain; declines westward; is traversed by Onion river, and contains the mouth of La Moelle river, - - - - - - - - - - - - -	690	16,055	21,765	31½	13
anklin,	Reaches from Chittenden, along Lake Champlain to Lower Canada. Declivity westward, and drained by La Moelle and Mississque rivers, it containing the mouths of both these streams, - - - - - - - - - - -	850	17,192	24,525	29	20
and Isle	Lies in Lake Champlain, and is composed of the island of the same name, and of a peninsula jutting southward between the two northern bays of the lake, - - - - - -	90	3,527	3,696	41	5
ashington,	Is the only county of Vermont which can be called central. It is entirely bordered by other counties of the same state, having Orleans N.; Caledonia N.E. and E.; Orange S.; Addison S.W.; Chittenden W.; and touching Franklin on the N.W. This county lies in the elevated valley between the two main Vermont chains, and is entirely within and very nearly commensurate with the upper part of the valley of Onion river. The declivity is N.W. by W. nearly, and very rapid. The country around Montpelier is about 550 feet above the Atlantic tides, but in 10 direct miles eastward at the summit between the sources of Onion river, and those of Wells, Watts, and White rivers, the acclivity amounts to from 800 to 1000 feet, - - - - - - - - - - - -	540	14,113	21,378	39½	17
rleans,	The middle county of Vermont, on Lower Canada, follows Washington in the same valley. Here we meet a real table land. The greatest length of Orleans is from south-west to north-east 50 miles. La Moelle river, rising in Caledonia, flows to the west of south-west over the south-western part of Orleans, giving to that section a slope towards Lake Champlain. The north-western part slopes to the northward, and					

Table continued.

County.	Natural Position and General Features.	Square Miles.	Population, 1820.	Population, 1830.	Pop. to Sq Mile, 1830.	No.Po.Offices,183
	is drained by the extreme higher branches of the Missisque river. The much larger part, however, of the whole county is included in the higher valley of Memphramagog; Black, Willoughby, and Clyde, confluents of that lake, all rise in Orange, and the region they drain declines to the northward. The central part of this county is an elevated region; Lake Memphramagog is itself 652 feet above the ocean level, and where a contemplated canal or rail-road is to pass between the sources of Passumpsic and Willoughby rivers, the elevation is 1175 feet relative height, - - - - - -	860	6,976	13,980	16	17
	Total, - - - - - - - - - -	8600	280,657	279,776	32½	254

Summary of White Population, by Sex and Ages.

		Males	Females
Males—	under 5 years,	21,700	21,338
	5 and under 10,	19,406	18,632
	10 and under 15,	17,597	16,881
	15 and under 20,	15,782	15,753
	20 and under 30,	24,207	25,180
	30 and under 40,	15,763	16,264
	40 and under 50,	10,405	11,034
	50 and under 60,	7,051	7,152
	60 and under 70,	5,203	4,727
	70 and under 80,	2,203	2,086
	80 and under 90,	618	652
	90 and under 100,	48	87
	100 and upwards,	3	4
	Total males,	139,986	139,790
	Do. females,	139,790	
	Do. whites,	279,776	
	Free coloured,	881	
	Total population,	280,657	

Increase from 1820 to 1830, 44,893, or a little above 19 per cent.

By the census of 1830, there were in Vermont 153 persons amongst the whites, and 5 coloured persons, who were deaf and dumb: and 51 whites who were blind.

Political Geography.—Constitution; Judiciary; Legislature, styled General Assembly, composed of one house only, elected annually by the people.

Executive.—Governor, Lieutenant Governor, and Council of 12; all elected annually by the people. Every orderly freeman of 21 years of age, a citizen of the United States, and who has resided in the state one whole year next before the election at which he offers to vote, is entitled to the right of suffrage.

Judiciary elected annually by the General Assembly, is composed of a Supreme Court, consisting of three judges, and a county court for each county, with three judges each.

Sheriffs and justices of the peace also elected annually by the General Assembly.

History.—The first civilized settlement of Vermont, as far as recorded with certainty, dates no farther back than 1724, when Fort Dummer, on Connecticut river, was founded. In 1731, Crown Point, on Lake Champlain, was fortified, and settlements commenced on that side. Though vexatious to the early settlers, the political existence of Vermont, as a state, rose from its soil being claimed by both New York and New Hampshire. The first land grants came from the latter, but the former claimed the country under the Duke of York's patent. Before the revolution, both the contending colonies submitted their claims to the British crown, and New York prevailed. The country having been in great part settled under grants from New Hampshire, which the Assembly of New York declared null and void, compelled resistance, as a measure of self-defence, and Vermont was found at the commencement and end of the revolution unconnected with any contiguous colony. During the struggle against Great Britain, the Vermonters did their duty.

The revolution consummated, New York urged its claims of soil and jurisdiction, which were finally withdrawn, Vermont paying 30,000 dollars. This controversy ended in 1789, and the people immediately took measures to obtain admission into the Union as a state. On the 14th March 1791, Vermont became the fourteenth state of the confederacy.

The constitution under which Vermont entered the confederacy was superseded by another, which was adopted at Windsor, 9th July, 1793. Except to improve their country with roads, bridges, manufactories, and schools, the people of Vermont have afforded little element for history for thirty-eight of the last years of their progress as an independent republic.

VERNIER, or NONIAS. See QUADRANT, Vol. XVI. p. 285—286.

VERONA, a city of Austrian Italy, and the capital of Verona, a province in the government of Venice. It is agreeably situated on both sides of the Adige, partly on a slope, and partly on a plain, which extends far to the south. The river, which divides the town into two unequal parts, is crossed with four bridges of stone, of which that of Castel Vecchio is the most remarkable. The town is of an irregular figure, and is about six miles in circuit, the modern part extending considerably beyond the old walls. It is fenced by a moat and an earthen mound, and there are two castles on elevated ground, and a third on the plain, but it is a place of no strength. Verona has five gates. *Porte del Paglia*, built of stone filled with petrifactions, is elegant, and *Porta dei Borsari*, is an ancient double gate like those of ancient Rome. The principal streets are the Corso, where horse races are held, and that which leads to the Mantua gate. Some of the rest are well paved and wide, but others are narrow and dirty. The houses, though of an ancient aspect, look well, from many of them being built of marble. The principal square contains the handsomest houses.

Verona contains a cathedral, in which there is a fine bronze crucifix; besides several handsome churches. The church of St. Zeno has a fine facade and a grand portal, and its roof is sustained by rows of columns, each of a single piece of marble. The church of St. George contains a picture of the martyrdom of that saint, by Paul Veronese. The church of St. Bernardino contains the celebrated Capella Varesca by San Michelo. The ancient church of St. Nazaro is one of the finest monuments of sacred antiquity. The church of St. Maria antica, is adorned with the busts of the Scaligeri family. The town house is ornamented with busts of the learned natives of the city, Pliny, Catullus, Cornelius Nepos and Vitruvius. The building called the Royal Palace has never been completed. The other palaces are that of Bevilacqua, a stately edifice, Canossa, Gustaversa, Pompei Gherardini, &c. The museum and the academy have an elegant Ionic portico, and contain an interesting collection of antiquities.

The most important feature of Verona is the Roman amphitheatre, situated in the large square of Del Bro. It is composed of large blocks of marble without cement, and rests on a double row of massy vaults, where the wild beasts were kept. Its exterior circumference is 1331 feet, its greatest diameter is 464, and its lesser 367. The oval arena in the centre is 220 feet long, and 130 broad. The seats, staircases, and galleries are entire. The number of ranges of seats is 46, and it was capable of holding 23,484 persons. Near the amphitheatre stands the modern theatre built by Palladio, and having a fine portico. The Palazzo del Consiglio is a noble edifice, built by San Savino. The Academica Philharmonica and the Philoli contain a number of ancient monuments. Verona has a lyceum, a gymnasium, an academy of paintings, and a public library.

About half a mile from the city, in a garden, once the cemetery of a Franciscan convent, is a sarcophagus called the *Tomb of Juliet*. It is made of Verona marble, with a place for the head, a socket for a candle, and two holes for the admission of air.

The manufactures of Verona are silk, which is the chief one, woollens, leather, gloves, and shoes. Population 45,000. East Lon. 11° 1′ 15″. North Lat. 44° 26′ 17″. For an account of the petrifactions in the vicinity, see BOLCA, *Monte*, Vol. III. p. 624—630.

VERSAILLES, a town of France, situated 12 miles to the S.W. of Paris, and the chief place of the department of the Seine and Oise. From having been so long the residence of the court, Versailles is one of the most elegant towns in France. Its squares and market places are large and elegant, and its streets, which intersect each other at right angles, are clean and spacious. The avenues leading to the palace divides the town into two parts, the one to the left being called the old, and the other the new town, in which are situated the principal church and the handsomest buildings. Versailles has a cathedral and eight churches, a high school, a library, a cabinet of natural history, and a botanic garden. The following is an account of the palace and gardens, &c. as they were in 1814.

"The palace itself, when viewed from the west, consists of a centre and two wings. The central building is composed of three sides of a square, the square projecting in front of the wings which are connected with it. The whole front towards the garden is 1965 feet in length. It consists of two stories and an attic, and is decorated with Ionic pilasters and columns, and adorned with numerous statues, nearly 14 feet in height, representing the four seasons, the twelve months of the year, and the arts.

"In the north wing, near its junction with the main body, stands the chapel, which was begun in 1699. When viewed from the west front, it does not appear as a separate building, excepting by the elevation of its roof, which rises higher than the palace. It is 134 feet long outside, and is decorated with 16 Corinthian columns and 22 demi-columns upon the wall, between which are 12 elegantly coloured glass windows. The marble pavement, the sculpture, and the painting renders this chapel one of the most elegant buildings of the kind in Europe. The apartments of the palace are reckoned 1532 in number; but as the whole of it was undergoing a complete repair, it was difficult to examine them with attention. Notwithstanding the scaffoldings also were placed in every apartment, the extreme richness and splendour were sufficiently visible, marble and gilding and the finest paintings being profusely lavished on every apartment. The saloon of Hercules was particularly grand, and the great gallery, which stretches along the front side of the central square, exceeds all description. It is 288 feet long, 41 feet broad, and 50 feet high. It is illuminated by 17 windows, with corresponding arcades on the opposite side, and the pilasters and columns are all of marble with gilt bronze capitals and bases. At the back of the central part we were shown the balcony upon which the King and the Queen and Dauphin presented themselves to the mob during the revolution.

"On the west side of the south wing stands the orangerie, which is reckoned the finest in the world. It lies very low, and we descend to it by two noble stone staircases. There is about 1000 orange trees, and the oldest of them has the following inscription upon it: '*semé en* 1421,' so that it is now 409 years old. The trees are all in green square boxes of wood, and each box is numbered, and has also the year in which the tree was planted or brought to the orangerie. The *Serre*, or apartments under the terrace into which the orange trees are put in winter, forms three sides of a square, the other side opening by an iron railing into the piece of water of great extent. The principal side, which looks to the south, is 624 feet long, and 48 wide over the walls, which are 12 feet thick. The other side, reckoning to the extremity of the staircase, is 465 feet long.

"On the west side of the north wing is a huge basin of water, of great extent, ornamented with numerous bronze figures, and with jet d'eaus, jerbs, &c. of all kinds. Before the front of the palace, and extending to a great distance, there were numerous extensive basins of water, lined with marble, and containing jet d'eau of every variety. As the Dutchess of Angouleme happened to visit Versailles on the same day with us, we had the good fortune to see all these brilliant waterworks in full play.

"Among the numerous objects of interest which cover the beautiful and extensive grounds of Versailles, I was much struck with the *Bosquet de la Collonade*, and with the *Bains d'Apollon*. The Bosquet consists of a circular peristyle of marble 105 feet in diameter, having 32 columns 16 feet high, formed of different kinds of marble, with their capitals of white marble. Each of the columns corresponds to a pilaster of white Languedoc marble, and the columns support as many arches, the keys of which represent nymphs, naiads, and sylvan deities. The peristyle is surmounted by a cornice, and the cornice by a socle or plinth, on which are placed vases of marble. In the triangular tympanum there are numerous bas reliefs of different articles. Within each arch, exactly below the key-stone, there is a basin of marble, from which the water is thrown up in a jet 17 feet high. As there is no marble basin at this entrance, the number is, of course, only 28. The *Bains d'Apollon* or *Le rocher*, as it is called, consists of a large artificial rock, built of stone from St. Cloud. A grotto, with the appearance of imperfect pillars, is formed in the rock, and its entrance, which is intended to represent the palace of Thetis, is decorated with a fine group seated in the middle of six nymphs. On the right hand of the spectator, and near the bottom of the rock, is another group, representing the two steeds of Apollo taken to the water by the Tritons; on the left hand there is another group, consisting of two Tritons and two steeds. Torrents of water run down different parts of the rock, and form a pool in front of it. The joints of the stones of the rock are distinctly visible, otherwise it might be considered as natural. It is fairly embosomed in wood, and numerous exotic plants grow in the crevices."

The manufactures of Versailles are, one of firearms, and clocks and watches. The spinning and weaving of cotton, and the bleaching of linen are carried on to some extent. Population about 30,000.

VESPUCCI, or VESPUCIUS AMERIGO, was born at Florence, on the 9th March 1451, of a noble family. He was the third son, and was educated under his paternal uncle, a learned friar. He went to Seville to look after some commercial concerns, and he appears to have been in that city when Columbus returned from his first voyage. According to the statement of Vespucci himself, he sailed from Cadiz with four caravels, and after touching at the Canaries, arrived in 37 days at the coast of Paria. If this be true, he was the first discoverer of the American continent, and anticipated Columbus by a whole year, but there seems to be very little doubt that this account is an entire fiction. He sailed, indeed, in May 1499, but only as a passenger in the expedition fitted out by Ojeda. Touching at the Carribees, the expedition visited the Gulf of Paria, and afterwards Hispaniola. At the invitation of the king of Portugal, he took the command of three vessels, which sailed in 1501, and reached a point five degrees south of the line. He set out again in May 1503, with the view of going to the East Indies, but he was driven into All Saints bay, on the coast of Brazil, to which he gave its name. In 1507, he returned to Seville, into the service of the king of Spain, who appointed him, in 1508, pilot-major, with an annual pension of 71,000 maravedis, and it is said, that in this capacity, he inserted his own name, or that of *Amerigo's* land, in the maps of the new world which he projected. This, however, is not believed by Mr. Washington Irving, who ascribes to future geographers the application of Vespucci's name to the new world. Vespucci remained at Seville, and retained his office till his death, on the 22d February 1512, though it has been stated that he died in 1516, and was buried in one of the Azores. For a full and interesting account of this navigator, see Washington Irving's *Life of Columbus*, vol. iv. p. 157—191. APP. No. IX. See also the *Family Library*, vol. xi. where there is a fine portrait of him.

VESUVIAN. See MINERALOGY, *Index*.

VESUVIUS.

Vesuvius, a volcanic mountain, situated in the kingdom of Naples, about six miles to the eastward of the capital. By the ancients it was called Mons Vesevus, or Vesbius, and in the earlier ages of antiquity, it was famed for the luxuriance of the vegetation with which its sloping sides were covered, as it also is in modern times, except in those spots laid waste by recent streams of erupted lava. On three sides, the mountain overlooks the rich plain, termed from its exquisite cultivation, and the diligence of its peasantry, with equal propriety the *Terra di Lavoro*, and the *Campo Felice*, while on the fourth, it descends more abruptly to be washed by the waves of that splendid expanse of water, to which it adds so high a charm, the Bay of Naples, its base here being covered by a connected chain of large villages, forming a stretch, perhaps almost unexampled, of many miles.

In regard to geological position, several important facts are to be noticed; and in the first place, the whole tract of country, within several miles in every direction landward of Naples, which has all the same general constitution as that small portion called the Phlegræan fields, must be considered as a formation subordinate to its main feature, Mount Vesuvius, as owing its existence to essentially the same phenomena, and as an actual superposition of a tract of country upon the pre-existent chain of the Apennines, which probably was at one period washed by the sea. The western limit of the Bay must then have been the Monte Massico, not far from Mola, instead of the island of Ischia, which now terminates it, the eastern limit or the promontory of Minerva remaining constant, which gives an opening more than double the present one, and the extreme depth of the bay, full fourteen miles greater. The whole volcanic formation of which Vesuvius forms the focus, reposes therefore upon the secondary limestone of which the Apennine range is here formed; and of this we have various direct proofs, the most remarkable of which is the frequent projection of calcareous masses from the crater of Vesuvius, either in an unaltered or a modified state; we have therefore the conclusive certainty, that between the volcanic focus and the point of eruption, there exist calcareous strata. The proximity of this volcano to the sea likewise deserves notice, as following the general law pointed out in the article Physical Geography. "Volcanoes," it is there remarked, "seem in general to be situated near the sea-coast, and rarely or never in the interior of large continents. Catopaxi, in South America, is perhaps, of all volcanic mountains, the most distant from the ocean, and yet it is only 140 miles distant from the shores of the Pacific." This is one of the few general facts recognised in connexion with the theory of volcanoes, and ought therefore to hold a place commensurate with its importance in hypothetical reasoning on this subject.

In taking a general view of the external features of Vesuvius, we are in the first place struck by its remarkable separation into two very dissimilar parts; Vesuvius, properly so called, a cinerous cone rising from an irregular plain, situated at no less than 2400 feet above the sea, and Monte Somma, a craggy range of rocks, the precipitous side of which is formed into the segment of a circle, and presents its concavity towards the cone of Vesuvius, which it flanks to the northward for a considerable extent, its own north side sloping gradually down to the plain of the *Campo Felice*. It is similar, in many respects, to the remarkable hill of Salisbury Crags near Edinburgh, if we conceive the perpendicular face of the latter to have a concave instead of convex horizontal projection, and instead of the debris which form the steep slope to the westward, a plain be conceived to extend from the base of the precipitous rock till it joins the cone already mentioned.

Monte Somma appears undoubtedly to have been the primeval point of ejection, though the conjecture of some authors, that the present concavity formed the wall of a part of the original crater, seems extravagant, as the circle of which it is a segment would have had a circumference of many miles. Some traces of what may have been the original crater may be observed in the course of this precipitous range near its western extremity. The face of rock there presents a remarkable section, the main body being traversed by dykes which pursue contorted courses, and frequently merge into or cross one another; they are of a different species of rock from the basis, and may probably owe their origin to fissures made by the subsidence of the upheaved pre-existent rock, and filled up by a new species of lava at the next eruption. See Saussure in the *Geneva Transactions*, vol. ii.; Sir James Hall in the *Edinburgh Transactions*, vol. vii.; Hamilton's *Campi Phlegræi*, and the *Edinburgh Journal of Science*, vol. ix. p. 191. The extreme height of the Somma is 3703 feet.

At the western extremity of the Somma, rises an elongated tufaceous eminence, named Monte Cantaroni, on which at an elevation of 1971 feet, stands the well known hermitage of St. Salvador, and which is said to have been thrown up by the eruption of A.D. 79, when the whole features of the volcano seem to have been changed, and when the present position of the cone probably first became the point of emission. This spot is protected from the effects of streams of lava which often pass near it, by a valley on each side, which serve to guide the torrent in different directions; one of these is called the Fossa di Faraonte, the other Fossa Grande; *Fossa* being the name here for these deep and narrow ravines with which Vesuvius abounds;

the latter of these is interesting from the vast abundance of simple materials which it affords.

The cone, or Vesuvius properly so called, next demands attention. Its height is liable to considerable variation from the explosive effects of eruptions which have been known to carry off at once 800 feet of perpendicular height of the summit. The Abbe Nollet in 1749 found the height above the sea to be 3120 French feet, while Della Torre in 1752 gave from his very imperfect measurements with the barometer only 1677 feet, a singular proof of the enormous errors which at that period might be committed without immediate detection. The first good observation we have is that of Saussure, making the height 3659 French feet, which is very interesting, by showing, as Humboldt has remarked, that this level is more constant than we are apt to imagine. Shuckburgh found the edge of the crater from which the lava of 1776 flowed to be 3692 French feet = 3935 English. The point which Saussure measured was on the N.W. side of the crater, and from a post which was fixed upon it was named *La Rocca del Palo.* In 1805 Gay Lussac found this point 3757 English feet, and Lord Minto in 1821, 3963, and at that time, forty-nine years from its first measurement, it was carried away by the great eruption. To methodize the results with as much accuracy as the nature of the operations in general warrants, we give the height of the Rocca del Palo by different observers, in toises merely (= 6.3947 English feet) from a late work of Humboldt's.*

	Toises.
1773. Saussure (barometer)	609
1794. Poli, do.	606
1794. Breislak, do.	613
1805. Gay Lussac, De Buch and Humboldt, do.	603
1810. Brioschi (trigonometry)	638
1816. Visinti, do.	622
1822. Lord Minto (barometer)	621
1822. P. Serope, do. slightly uncertain	604
1822. Monticelli and Covelli	624
1822. Humboldt, do.	629

There is an appearance of greater elevation during the latter part of this period, which Humboldt thinks may amount to 12 toises, to be considered a proof of gradual internal elevation.

The proportion of the cone of ashes to the total height is in Vesuvius $\frac{1}{3}$ nearly, whereas in the volcano of Pichincha, it is only $\frac{1}{10}$, and in the Peak of Teneriffe so low as $\frac{1}{22}$.† The mean slopes of volcanic cones are, according to Humboldt, from 32° to 42°; the mean slope of Vesuvius between the summit and the Atrio del Cavallo, is probably equal to the highest of these values. The base of the cone is about 2480 feet above the sea.

The crater by which the cone of ashes is truncated, has varied in character and dimension very much, according to the state of the volcano. Subsequently to the eruption of 1822, when so vast a portion of summit was carried away, the crater has been, according to general computation, no less than three miles and one-third in circumference, and 1500 feet deep; being probably the largest in existence. This confirms the view given under the article Physical Geography, (Vol. XVI.), that, generally speaking, the size of craters is inversely as the height of the mountains to which they belong; even the case of Pichincha, which has a crater a mile in diameter, there quoted as an exception, we now see outdone in the comparatively diminutive example of Vesuvius. The American volcano is no less than *four* times as high as that of the Bay of Naples, or near 16,000 feet; Mount Etna, which has an elevation of 11,000 feet, had in 1769 a crater only $2\frac{1}{4}$ miles in circumference, and that of the Peak of Teneriffe, which has a height of above 12,000 feet, is only 300 feet long, 200 broad, and 100 deep.

The edge of the crater is narrow and precipitous, sloping internally and externally so fast, as to leave but a small ridge to walk upon. As to height, it is very irregular, the northern point being 500 feet higher than the southern. The depth of the crater below the lowest edge, is probably little less than 1500 feet, from which some idea of the true size of this vast chasm may be formed. The southern side presents so moderate a slope inwards, that without any peril, the traveller may descend till within about 500 feet of the bottom, where he is stopped by a precipitous crag; in the opposite direction it is so steep, that we cannot descend above a few paces. Various, indeed, are the modifications which the crater has assumed under different stages of volcanic energy. Previously to the first recorded eruption of A.D. 72, the summit exhibited, according to Strabo, a level plain, interspersed with rocks and caverns, which were rightly interpreted, as bearing marks of previous imflammation. Before the great eruption of 1631 took place, which succeeded to a long period of repose, the crater exhibited the most deceptive marks of quiescence; it was then 5000 paces round, and 1000 deep; in the bottom was a plane where cattle grazed, and the banks were clothed with abundant forests, in which wild boars took shelter, and afforded sport to the lovers of the chase. The sloping path which led to the bottom is said to have been three miles long. Three small lakes existed there, of which, according to the report of contemporary writers, one was warm, another salt, and the third bitter. It appears from the curious old representation of the mountain at this period, copied into Mecatti's account of Vesuvius, that the Monte Somma was covered with trees to the top, as was also the base of Vesuvius. In 1660 the crater was so shallow that it was easy to descend to the bottom, where a small cone was raised by the immediate action of the volcano. In 1755, the bottom was only 23 French feet below the edge, and from the centre rose a parasitical cone 80 or 90 feet in height, with its own proper crater. How different these conditions were from the present one, the dimensions already given will show.

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* *Tableaux de la Nature.*

† Humboldt's Personal Narrative, I. 207.

In order to convey a general idea of the features of this volcano, we shall give a brief account of the ascent, which is a matter of no difficulty, and may easily be accomplished by ladies.

There are different tracks by which the mountain may be ascended, but that universally preferred is by Resina, and it alone we shall describe. This village lies at the base of the mountain near the sea-shore, and is about six miles east of Naples. Here the traveller may think himself fortunate if he can secure the personal attendance of the elder Salvatore, one of the best guides who can be met with for any such expedition; asses are usually taken to diminish the labour of the ascent. For some way the road is simply rugged and stony, bounded by high walls inclosing those extensive vineyards which produce the admirable Lacryma Christi of this vicinity; currents of lava will occasionally meet the eye of the traveller, and on the right hand he will remark an unfortunate house, one half of which has literally been swept away by such a stream, whilst the other has been left entire, as if to tell the tale. Farther on, cultivation in a moment ceases, and all the luxuriance of nature and of art combined is exchanged within a few yards for a degree of obdurate sterility in the one which bids defiance to all the ameliorating efforts of the other. In a word, we have reached the western extremity or embouchure of the Atrio del Cavallo, and we see stretched before us the combined streams of the eruptions of 1767, 1771, 1819 and 1822. The last is not here so strikingly repulsive as higher up the valley, as we shall presently describe; that of 1819 is remarkable for the peculiar ropy form which it has assumed, being nothing else than the effect of successive waves of scoriaceous matter forcing up the imperfectly solidified substance of the preceding ones; hence it has acquired the appropriate name of "Lava Corde." Near it may be seen rudely intermixed tabular masses; these have been produced by the insinuation of a liquid stream below a thin but solid crust of lava which it has shattered, and then recombined the fragments. A few lichens on the lava of 1767, are all the marks of decomposition which it yet exhibits, and those on the current of 1819 are little better than microscopic; yet even these are farther advanced than some other lavas in the Bay of Naples which have lain exposed for centuries. We next reach the Monte Cantaroni already mentioned, which presents a steep ascent; the highest point of this huge protruded mass of tufa is occupied by the hermitage of St. Salvador, where the monks live, who rather lead the life of publicans than eremites.* It is to be observed, that coming to Monte Cantaroni at all, is quite out of the direct line of ascent, for we must again cross the Atrio del Cavallo; but besides having the benefit of some species of road, the traveller who wishes to see the mountain, will do well to make this digression. Leaving St. Salvador, we pass near the "Cratere del Francese," where in 1819 an unfortunate Frenchman, after living three days at the hermitage, plunged into the boiling abyss of lava, and met a fiery grave. Once more descending from the tufaceous eminence to the plain, we leave to the left the Monte Somma, and "Fossa di Faraonte," into which flowed the lava of 1785, and which divides it from Monte Cantaroni, and set our faces towards the cone of Vesuvius.

It is impossible to convey any impression of the state of this broad plain to those who have not visited similar scenes. The amorphous mass of stony matter deposited by the last great eruption (1822) has an appearance of sterility which no other rocky formation presents; and for this plain reason, that upon these natural causes of gradual but sure degradation have been working for thousands of years, while here the newly moulded matter is ejected unformed and intractable as when it so lately existed in the bowels of the earth. The small scale of artificial penetration of the strata at which human labour has arrived, can convey no idea of their primeval form: the difference lies in the comparative symmetry of our mining operations as well as in the trifling extent of surface they present; but this valley consists of several square miles, and the entire western portion is buried under this stony inundation, hard, black, and rugged, sometimes swelling into craggy eminences with narrow cavernous hollows between, or occasionally flowing in a thinner stream over the flat-bed prepared for it by the pre-occurrence of a tremendous shower of ashes, above which it has formed blistered cavities, into which shoot spicular masses of the same dark intractable material. The only variety with which the eye meets in this great plain, is here and there an ejected mass of many cubic yards content, discharged from the mountain with such explosive force as to be driven far from the base of the cone: all else has but a symmetry in horror. Nature here wants the majesty and elevation of rocky cliffs, or the rich coating of verdure, or the more interesting struggle of vegetable luxuriance with an arid soil,—although but little removed from the fertile slope of the hill and the vast expanse of the highest cultivation which environs its base, these beauties only contrast the more with the dark, cold, monotonous lava of which the distorted forms seem to partake of mobility, were we not assured by our senses that it were the work of centuries to reduce the rugged configuration of this siliceous rock.

Arrived at last at the foot of the cone of ashes, the traveller must leave his mule or ass, and trust to his feet in ascending that fatiguing, though in the present state of the mountain, short ascent. An active man may accomplish it in thirty minutes, though not without great labour, from the sinking and sliding of the volcanic ashes. His trouble, however, will soon be overpaid by the spectacle which awaits him on reaching the summit. And first he will naturally look inwards towards the crater at which he has at length arrived. Its vast magnitude, the ruggedness of its extreme edge, the appalling abruptness of the precipice from the summit of which he first obtains his view, the loud and repeated echoes which the shrill voices of the guides excite through the cavern, and the curling smoke rising from the abyss, often concealing by its dense volumes the remote recesses, and not unaccompanied perhaps, with internal boiling of the igneous fluid, the chance ejection of stones, or the occasional fall of rocks, the noise of whose descent is responded to by a hundred cliffs, all makes the scene one, the first impression of which is so noble, so striking, as perhaps is not to be renewed. But let him examine the structure more closely. In the late state of the mountain (we speak of the years 1826-7), he might without the shadow of danger descend two-thirds of the depth of the crater, by walking round a semi-circumference of it till he arrives at its south-eastern point. There the internal side, instead of presenting the abrupt precipice of its opposite extremity, shelves gradually inwards, aided by the much reduced elevation of its edge, which differs more than 500 feet from the N.W. point. Here we may descend till we reach a precipice 500 feet in height, which separates us from the bottom; and from this lone and unfrequented spot we may at leisure survey nature in some of her most remarkable forms. We tread amidst thick beds of sulphur, the crevices of which often emit steamy spiracles rapidly condensed by the chillness of the air, which is frequently great even amidst these subterranean fires. The shades of colour which the sulphur beds present, are most varied and beautiful, from the palest straw colour, where the pure yellow is diluted with the white deposits of decomposed lava, and occasionally of sulphate of alumina, up to the rich orange, which the intermixture of arsenic, forming red and yellow orpiment, occasionally presents. But grander scenes and sterner formations withdraw the attention of the observer from the mineral world immediately beneath his feet. He has but to raise his eyes to see the distended jaws of this great abyss stand in all their ruggedness before him. Huge misshapen crags rise on either hand, only their salient points conceal the remoter trendings of that volcanic plain which stands poised over unfathomed caverns, the laboratories of Cyclopian energy. The plateau of the crater is indeed but a crust, of which upon any excess of volcanic explosive force below, we have abundant proof by the formation of miniature craters, through which may be distinctly heard on such occasions, the boiling noise of internal agitation, and the rattling of stones, elevated from the pit, with the constantly succeeding columns of smoke which are the consequence. Nature seems to have completely barred the volcanic plateau from the access of mortal foot, in the present state of the mountain, yet the hardihood of strangers sometimes induces them to descend by means of ropes these tremendous natural ramparts, with the great danger of detaching masses of rock in the course of their descent. In this, as in all other enterprises of which empty vanity in personal achievement is the only excitement, we regret to add, our countrymen predominate in numbers: whether the task be to scale the frozen summit of Mont Blanc, or grapple with the embryo thunderbolt at the very forge of Vulcan; or the easier feat of scratching initials on the Ball of St. Peter's,—in every act of vain-glorious temerity the English name is pre-eminent.

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* On all the three occasions on which the author of the present article ascended Vesuvius, he reached the hermitage in about an hour and a half from Resina.

From the edge of the crater the distant view is almost equally worthy the traveller's attention in surprising contrast with the spectacle of its interior:—*there* the rudest elements employed in the laboratory of nature, the unformed heap, the chaotic confusion, the groaning or thunderous sounds as of Nature's throes:—*here* robed in her fairest forms and hues, displaying all the beauties of recondite arrangement, and refined collocation of parts; the riches of her different kingdoms combined to form as it were a model of inartificial perfection. At sunset especially the scene may be most fully appreciated; the further beams of the great luminary as he sinks behind the remote shore of Gaeta, gild the distant waves of the Tyrrhene Sea, and invest the more abrupt points of the Italian shore with a halo of misty splendour. Nearer the eye, they throw long shadows from higher eminences in the Bay of Naples, the island of Ischia with its once volcanic summit, formerly much more to be dreaded than the now active Vesuvius; the hill of the Camaldoli; the humbler ridge of Pausilipo. The ancient craturs of Averno and Agnano, now occupied by lakes, demonstrate their true form by their deepening shadows, the domes and spires of Naples, and the old grey turrets of the Castel St. Elmo receive, and part with the declining solar ray,—and whilst on the left, the towering hills of the promontory of Minerva, which form the eastern wing of the Bay, blaze in the broad expanse of sunshine, the distant Apennines behind the spectator as he faces the setting luminary, sink in the greyness of the twilight, and are soon lost in the dewy mists of the horizon.

The phenomena of eruptions are in all volcanos perhaps, very similar in a general view. Preceding earthquakes, subterranean noises, drying of wells, occasionally retirement of the sea, intimate the near approach of the catastrophe, and these are succeeded by heaving and splitting of the mountain, stillness and cloudiness in the air, accompanied with a highly electric condition, which imparts to the eruption some of its most extraordinary accessory phenomena. The explosive force from below having opened a rent in the crater, a vast discharge of gaseous fluids follow, and though not unoften accompanied by boiling water in streams, Vesuvius more frequently discharges showers of dry impalpable volcanic dust, so fine as to be sustained a considerable time in the higher regions of the atmosphere, where having attained the height at which the continued force of gravity and the diminished density of the air overcome the projectile momentum, the thin tall stream accumulates and spreads, having something of an umbrella form, or more accurately, that of the Italian pine (*Pinus Pinea*) to which it was first compared by Pliny, and for which this mountain has ever been remarkable.[*] The dusty particles then descend over a vast extent of country, in a thick shower. It rarely happens that the crater is in a state to afford a ready overflow of lava, and therefore from the simple principles of hydrostatic pressure, that fluid bursts for itself a point of emission near the base of the mountain, and frequently elevates a parasitic cone. Thus the lava of 1794 (that dreadful eruption which last overwhelmed Torre del Greco) issued from a crack at the base of the cone, on the Pedamentina, about half a mile in length according to Breislak, and 100 yards wide. In the eruption of 1760, no less than fifteen mouths opened on the southern side of the mountain, raising as many cones, but the number of which was soon reduced to seven, and finally to four, the height of one of which is 200 feet. Again in the great eruption of 1822, several small cones were raised in the Atrio del Cavallo, between Vesuvius and the Hermitage.

Referring for more detailed accounts of particular eruptions, or of their general features, to the works of Hamilton, Breislak, Della Torre, Mecatti, and Scrope, we may mention the connexion which has been supposed to exist between Vesuvius and other volcanic emissaries. This question is a very important one, yet is still involved in considerable doubt. Breislak, who had the best means of judging, strenuously denied it,[†] but we must suspect his judgment to have been biassed by preconceived opinions, from the general conception of the reverse which prevails respecting the connexion at least of Vesuvius and Solfatara, a sentiment which we ourselves have had the means of confirming, and which Sir Humphry Davy, a philosopher whose temperate judgment must ever command respect even for his hypotheses, expressly countenances. He observed the Solfatara on the 21st February 1820, two days before the eruption of Vesuvius was at its height; "the columns of steam," says he, "which usually rise in large quantities when Vesuvius is tranquil, were now scarcely visible, and a piece of paper thrown into the aperture did not rise again, so that there was every reason to suppose the existence of a descending current of air."[‡] It might however be supposed, that the connexion of two volcanoes so nearly approached as Vesuvius and Etna, would be more defined than it appears to be. Among 50 eruptions of the former, and 48 of the latter, occurring since the Christian era, the following are the nearest coincidences.[§]

VESUVIUS.	ETNA.
1694. March 12.	1694. March to December.
1754. December 2.	1755. March 2.
1759 August 3.	1780. May 18.
1787. October 31.	1787. July 28.
1799. February.	1798. June. 1799. June.
1809. December 10.	1809. March 27.
1811. October 12. —— December 31.	1811. October 25.
1819. May 27.	1819. November 25.

We must next very briefly notice the more important mineral productions of Vesuvius, confining ourselves to those of great extent and volcanic origin. These may be divided into lava, breccia, tufa, and volcanic dust.

Of a few of the external forms of lava we have already given some notice. The really ornamental lavas are chiefly found in the Mount Somma, and constitute the remarkable dykes or veins to which we have also referred; they consist of a compact basis imbedding many beautiful and perfect crystals of leucite, a mineral, nearly, if not altogether, confined to the volcanoes of Italy: they are called partridge-eyed lavas, and have a beautiful appearance. The Vesuvian lavas, for the most part, are hard and compact, and frequently approach in appearance to a perfect identity with some of our greenstones and basalts. Hence it is much used for paving, and the road between Naples and Portici is a perfect specimen of this application. It is quarried from the couleè of 1794, near where it flowed into the sea, and here a striking tendency towards the assumption of prismatic forms may be observed, and it is even probable that excellent cabinet specimens, having the columnar structure, might here be obtained; nothing indeed can more perfectly resemble a quarry of basalt; and the chain is so complete through the medium of the lava of Capo di Bove near Rome, and the extinct volcanoes of Auvergne, that the question of their similarity of origin is probably for ever set at rest. The varieties of lava found in Vesuvius is very great, and not less than twenty-two very distinct ones have been enumerated in the Monte Somma alone. In general, however, they are rough, opake, and without lustre, very rarely indeed presenting the vitreous lustre. Hence obsidian is one of its most uncommon products, though met with in considerable quantity in the neighbouring island of Ischia; it is only, we believe, found in small ovoidal cavities, principally confined to the leucitic lavas of the Monte Somma, and from that point of ancient emission the small quantity of pumice which is found in detatched masses on the mountain, seems also to have proceeded; these two minerals being probably very nearly allied in their formation. Lava highly cellular is not an unfrequent production of Vesuvius, and small spheres of it are frequently ejected along with volcanic sand, and by their lightness reach great distances. The cavities are occasionally coated with muriate of copper, as in specimens from the "Cratere del Francese."

In the crater, lava exhibits a very different form; the action of heat and moisture, but especially the acid vapours which are abundantly evolved, soon effect the disruption of those affinities by which the compact condition of the rock was maintained. The most powerful agent is sulphurous acid, which at the same time, forming a neutral salt with the iron, which is by far the most abundant colouring matter of the rock, leaves, ere its action is finished, the dark, rugged, intractable lava in the plastic condition of a white powdery clay. At the Solfatara this operation goes on with regular energy, and rocks may there be seen in a condition almost identical with the claystone porphyry of the trap formations. The quantity of potassa contained in the lava of Mount Vesuvius proves eminently favourable to the soil formed by its disintegration.

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[*] That the phenomena of the "Cenere" or showers of ashes depend upon no extraordinary principles, is illustrated by favourable examples of the ascent of material particles of smoke in the air. We remember to have witnessed a very interesting confirmation of this near Edinburgh. Just behind the cone-like summit of a trappean mass in the eastern Pentland range, a quantity of brush wood had been set on fire. The air was remarkably calm and clear, and the beautiful column of smoke rose clear and defined with the crater-like eminence of trap rock just in front, then spreading on all sides where the cold increased, and the specific gravity of the air diminished, it bore a most perfect and interesting resemblance to the majestic Vesuvian pine.

[†] Voyage Physique dans la Campanie, ii. 70.

[‡] Phil. Trans. 1828.

[§] Daubeny on Volcanoes, p. 216.

The *Brecciated* lavas of Vesuvius are chiefly interesting from the adventitious fragments which they contain, belonging to the primitive or older secondary strata, which, being elevated by volcanic agency, are imbedded in a basis of the lava of the eruption to which they may belong. Granite and gneiss are sometimes found to be ejected from the crater, but what in some respects is most interesting, the masses of coarse Apennine limestone so thrown out are found in a remarkably changed form, being converted into a fine granular white marble, nearly of the nature of dolomite. But we cannot enlarge farther on this curious topic.

Volcanic tufa may be said to form the connecting link between many ancient volcanic formations and those of modern date. We see in the Bay of Naples the old tufas forming whole hills and districts, which, for time immemorial, have existed in their present form, and which, for many cogent reasons, may be conjectured to have been elevated from the bottom of the sea. Again we see this rock identified in the stony crust which covers Herculaneum, and which, far from being a lava, as has often been alleged, appears to have owed its fluidity to moisture rather than fire. Its origin is revealed by modern eruptions, in which the formation of tufa occasionally occurs. We have in our possession a real specimen of this nature, produced by the eruption of 1822, and retaining the impression, or rather the substance of the leaf of a tree; it is nothing else than consolidated mud, proceeding from the partial solution and mechanical mixture of the solid materials of the mountain uniting with water at a high temperature, perhaps derived from the ocean. Tufa is therefore probably identical with the products of the salses or mud volcanoes of Modena, Sicily, and other places.[*]

The eruptions of volcanic sand or dust which occasionally take place, we have already alluded to. Its comminution is extreme, and it is hence carried by the wind to distances almost incredible. It reached Egypt and Syria in A.D. 79, Constantinople in 472 and 1631, and was dispersed all over Calabria in 1139, and 1794. In the first year above mentioned it covered Pompeii to the depth of many yards, in union with grosser fragments of scoria and cellular lava, and in 1822 it lay finger deep in Naples at a distance of six miles. That this impalpably divided matter should reach to such a distance as Egypt, we need not reject as fabulous, since we have authentic accounts of dust raised from the deserts of Africa by no extraordinary phenomenon, reaching hundreds of miles to leeward, and covering the sails and decks of vessels. In the case of Vesuvius the quantity is sometimes so enormous as to create a great degree of darkness at considerable distances: of this Pliny has given us an interesting testimony in his account of the first recorded eruption. Some time since it was asserted by different Neapolitan chemists, that gold had been detected in the volcanic dust of Vesuvius: this fact, had it been confirmed, though curious, would not have been unexampled,[†] but it appears to be completely disproved by the Analysis of Rose and of Monticelli and Covelli.

The following is the analysis of the volcanic sand of 1822, from a very recent memoir on this subject.[‡]

	Sulphate of lime	6.50
	Muriate of Soda	1.50
	Lime	2 07
	Oxide of Iron	13 50
	Alumina	15.00
	Magnesia	1.50
	Silica	53 50
	Carbon	2.10
Volatile.	Water Muriatic Acid Muriate of Ammonia	3 13
	Loss	1.20
		100.00

The gases evolved during eruptions have justly been looked upon by chemical philosophers as highly important indices of the nature of the internal action, and from these, some beautiful speculations referring the source of volcanos to the oxidation of the alkaline and earthy bases, have most ingeniously been derived; but the distinguished author of that hypothesis was more lately disposed to found upon it some only of the more circumscribed phenomena of volcanic energy. The principal elastic fluids evolved by Mount Vesuvius are the sulphurous and muriatic acids; the former more particularly accompanying the stage of complete inflammation; the latter its incipient progress. There is a singular fact respecting the gases evolved by Vesuvius, mentioned by Breislak and confirmed by later writers, that while the muriatic and sulphurous acid vapours have proved most destructive to vegetable life, the olive and pear tree have been found free from its influence. It is certain from the experiments of Drs. Turner and Christison that different plants are very differently affected by the same gases, and the phenomena are such as well deserve farther investigation, not only in a chemical and physiological, but in an economical point of view.

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[*] In so rapid a sketch, it is difficult to avoid the chance of misinterpretation. In speaking, therefore, of the similarity of ancient and modern tufa, we have only meant to convey the general impression of their generic characters, which are much the same, although their mode of formation may have been considerably different. The tufas of Pausilipo appear incontestably to have been modified by the action of deep water, under which, in all probability, they were formed; and whether they emerged from the bowels o the earth in a dry or fluid form, we do not here inquire. See the *Edinburgh Journal of Science*, vol. x. p. 251, and *Daubeny on Volcanoes*, p. 411.

[†] Its presence has been vulgarly believed in the island of Ischia, and though this mistake appears to have arisen from an error of Strabo, we know that gold has been found, even abundantly, in volcanic formations. Breislak, Campanie, ii. 188.

[‡] Lavini. Memorie della reale Academia delle Scienze di Torino, tom. xxxiii.

The rigid limits to which we must restrict ourselves in this article, prevent our doing more than allude to the rich variety of simple minerals, many of them of great singularity and rarity, which are to be met with upon Mount Vesuvius. It combines the fine zeolites of the trap rocks, with the rich and splendid productions of primitive strata, including several of the gems, and many species quite peculiar. We must content ourselves with referring to a work now publishing at Naples, by Signori Monticelli and Covelli, entitled, *Prodromo della Mineralogia Vesuviana.*[*] A few of the principal species will be found enumerated in the *Edinburgh Journal of Science*, vol. ix. p. 206.

We must conclude this brief and imperfect article with a short sketch of the history of Vesuvius.

From the well known features of Mount Etna, the ancients had sufficient intelligence to draw the conclusion that although they had never seen Vesuvius emit flames, that it had once emitted similar devastation; an opinion probably countenanced by tradition, although we can found little upon the express assertion in the works of Berosus, that an eruption actually took place some hundred or thousand years before the commencement of the Christian era, as the writings which go under the name of that historian cannot be considered as genuine.

The first recorded eruption that took place was therefore that of A.D. 72, which must ever be memorable on that account, as well as the singular ravages which it produced, and the interesting account of some of its features which have been handed down in the elegant letters of the younger Pliny. The towns of Herculaneum and Pompeii being entombed by this eruption, were preserved, as if by a miracle, to modern times; two relics so truly extraordinary, so romantically interesting, as to resemble rather the fancy of some bright imagination, than sober realities placed within the reach of our senses. For farther information on these cities and the eruption by which they were overwhelmed, we must refer to the articles under their names, as well as the works there cited; and for a synopsis of all that is at present known concerning them, to a paper recently published, expressly on the subject.[†] To this eruption, according to the opinion of most naturalists, was owing a great change in the form of the mountain, and the total alteration of the primeval point of ejection, for we have already seen that the original crater probably existed somewhere in the escarpment of Monte Somma. The scale of the catastrophe must, in all probability, have exceeded that of any subsequent eruption. It seems most likely that a natural rent formed the present outline of the Monte Somma, and all the seaward portion of the mountain being thrown off, formed the basis or wide plain from which the new cone was to rise.

The second recorded eruption occurred A.D. 200. It was attended by loud subterranean noises. Others succeeded in the years 204, 243, 305, 321, 472, 512, 557, 685, 893, 980, 993, 1024, 1036, 1138, and 1430. Those of 472 and 1036 were the most remarkable. Between 665 and 1036, the eruptions were very slight, and the mountain, comparatively speaking, in a state of repose. In the latter year lava, to a remarkable extent is first particularly recorded; it then reached the sea. Considerable doubt has been thrown over the phenomena of the middle ages, by the imperfect records which have reached us from even a few centuries back. The eruption of 1138 was considerable, and lasted forty days. By some an eruption has been placed in 1306, and one extremely doubtful is related by one author only as occurring in the year 1500; that of 1430 was probably trifling. Of contemporary volcanic paroxysms in the vicinity, we may mention the eruption of the Solfatara in 1198, that of Monte Epomeo in the neighbouring island of Ischia in 1302, and the volcanic explosion which produced the Monte Nuovo—a hill in the bay of Baja, 420 feet high, and a mile and a half in circumference, in thirty-six hours. This took place in 1538.

The most tremendous eruption which had occurred since that under Titus, took place in the year 1631. The mountain, according to the general account, had been quiet for some centuries, its sides were cultivated and its crater wooded with luxuriant forests. The magnitude of the catastrophe was proportional to the deceptive appearances of repose before exhibited, and the injury occasioned was prodigious: not less than 4000 persons were killed, whole villages depopulated and burned, and vast tracts of territory laid waste by copious streams of lava. It is unnecessary to expatiate upon the particular descriptions of eruptions which, except in degree, are for the most part very similar. The minutiæ of this very remarkable one, have been carefully preserved by contemporary writers. Only 20 years after, the explosive energy again manifested itself, and produced a violent eruption in 1660. After this the mountain changed its character, by producing eruptions far more frequently than before, and, generally speaking, of less average importance. Those of the remainder of the century, in the years 1682, 1685, 1689, 1694, 1696, to 1698 were unimportant, with the exception of that of 1694. The eighteenth century likewise opened with a series of closely following trifling eruptions, particularly in 1701, 1704, 1708, 1712, and thereafter *almost every year*, till 1734. Then in 1737, 1751, 1754, 1759, 1765, 1766, and 1769, the last of which was more than usually violent. 1776—8. Here a pause occurred, during which the mountain seemed to gather strength for the catastrophe of 1794, one of the most tremendous of modern eruptions, and by which the entire town of Torre del Greco was destroyed. Breislak, who was an eye witness of this eruption, has given many interesting details regarding it in his work on Campania. We shall only quote the result of his curious calculation respecting the mass of lava ejected, not from the crater, but from the secondary openings formed near the base of the cone. He estimates its solid contents at 2,804,440 cubic toises, or about 733,350,000 cubic English feet; which would cover to the depth of a foot 16,836 imperial acres. Minor eruptions occurred in 1802, 1803, 1804, 1806, 1809, 1810, 1812, 1816, 1817, 1818, 1819, 1820; but in 1822, in the month of February, a paroxysm took place which proved the precursor of one of the most awful and magnificent on record, which happened in October. Fortunately its devastation spread in a direction calculated to produce little hazard of life, and was carried by the slope of the ground through the western embouchure of the Atrio del Cavallo. As an eruption, it probably was more remarkable than that of 1794, which was so abundant in the production of lava; but we have already seen that the old or *palo* summit of the cone remained untouched during at least half a century, before it was carried off with 800 feet of the cone, by the eruption of 1822. So completely emptied the mountain seems to have been on this last occasion, that it is improbable that any considerable eruption should take place for a long period. This rule, however, is often fallacious, and Vesuvius has already exhibited some minor marks of inflammation. A slight one occurred on the 22d of March, 1828.

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[*] An account of several new minerals discovered and described by these gentlemen, will be found translated from their work, in the *American Journal of Science*, October 1826.

[†] *Edinburgh Journal of Science*, x. 108.

On the ancient condition of Vesuvius the reader may consult *Strabo*, lib. v.; *Plinii Historia Naturalis; Florus*, iii. 20; *Seneca, Nat. Quæst.; Martialis*, iv. 44; *Plinii, Jun. Epistolæ*, xvi. 16 and 20; *Taciti, Hist.* i. 2; *Ann.* xv. 22; *Virgilius, Georg.* ii. 224; *Cluverius Italia Antiqua*, fol. vol. ii. For its modern history and description—*Il duca della Torre, Storia del Vesuvio; Mecatti Racconto Storico Filosofico del Vesuvio*; Covelli e Monticelli; *Storia dei fenomeni del Vesuvio*, Breislak, *Voyages dans la Campanie*, vol. i.; Hamilton's *Campi Phlegræi*, Naples, fol. plates; or translated into French with notes by Soulavie, Paris, 1781; Humboldt, *Tableaux de la Nature;* Spallanzani's *Travels in the Two Sicilies; Voyage Pittoresque dans la Royaume di Naples;* Lalande *Voyage en Italie*, tom. vii. A paper in Dr. Brewster's Journal, October 1828, vol. ix. p. 189. A vast number of detached pamphlets have been published on the separate eruptions which it is unnecessary to quote. On the mineral productions—Gioeni *Litologia Vesuviana*, and Monticelli e Covelli, *Prodromo della Mineralogia Vesuviana.* See also Silliman's *Journal*, October 1826. (Δ.)

VETERINARY MEDICINE.

This useful branch of general knowledge, in former years, and even now by the vulgar, called *Farriery*, has of late received the more appropriate and deserving title of Veterinary Art. In a medical point of view, it may be regarded as naturally allied to the science of human medicine; in other respects, however, its objects tend quite another way; and it is only by a happy amalgamation of acquirements of both descriptions, that veterinary science can be practised with its fullest advantages.

The Veterinary Art, according to the present acceptation of the phrase, comprehends a knowledge of the external form, as well as the internal structure and economy of our domestic quadrupeds; their appropriate management; the nature, causes, and treatment of their disorders; and the art of shoeing such of them as may be found to require it. The word *Veterinary* is an anglicism derived from the Latin adjective *Veterinarius;* which by some of the ancient writers, in particular by Columella, was used substantively to denote a *farrier, horse-doctor*, or *one who lets horses to hire;* its radicle being the verb *veho*, to carry; whence Veterinarius came to signify *any thing connected with*, or *relating to beasts of burden.*

Veterinary science shared the common fate of literature in general, during the interval known as *the dark ages;* and it was not until some time after the period of the universal revival of letters, and other arts and sciences, that the veterinary once more came to be deemed worthy the attention of men of respectability and education. To the French, in an especial degree, are we indebted for this meritorious rescue of our art from the trammels of ignorance and superstition. Solleysel, Bourgelat, and Lafosse shone first in the hemisphere of revived veterinary science, and have left behind them lights which will for years to come serve us as beacons through many obscure and trackless regions. In 1762, the first veterinary school was instituted, the one at Lyons; in 1766, that at Alfort was opened. A similar institution was founded at Berlin in 1792; and in the year following our present veterinary college at St. Pancras (close to London) was opened for the reception of pupils and patients, under the direction of Sainbel, its first professor, a Frenchman who had come over from France for the specific purpose of introducing the *study* of the art among us; and who succeeded, under the auspices of the Odiham Agricultural Society, in founding a college and creating himself professor. He did not live, however, for more than two years in the enjoyment of the dignities and emoluments which his praise-worthy exertions had obtained for him: he died regretted by those who personally and professionally knew him, leaving an appointment vacant, which was shortly afterwards divided between a gentleman who at that day stood high among horse people, Mr. Moorcroft, and a young aspirant, whose qualifications were purely medical, Mr. Coleman. Not long afterwards, the former of these gentlemen resigned his share of office, and obtained subsequently an appointment in India, as superintendant of the company's studs, leaving Mr. Coleman alone in possession of the professorship, which he continues to hold to this day. Such is a circumscribed outline of the *history* of the veterinary art.

An enlightened age has discovered that the study of the medical department of this art can be rationally conducted only upon a knowledge of anatomy and physiology. These are the rocks which the farriers are continually splitting and blundering against; the neglect of this the cause that has led to so much mystery, superstition, and malpractice among them. When we come to consider what a complicated machine an animal body altogether is, and how exceedingly its intricacy and importance must be enhanced by the circumstance of its being possessed of vitality, we can only feel astonishment we hardly know how to express, that such a set of ignorant men as farriers and grooms in general are, should have the assurance to pretend to be able to set that machine aright again every time it is out of order, concerning which they possess not one particle of knowledge, in regard either to its construction or its action, when it is in a sound and healthy state: but the truth is, that it is this very ignorance which carries them through the darksome wilderness into which want of common reflection alone on the part of their employers could have induced them to enter. As might have been with every just reason anticipated, then, anatomy and physiology have done much for veterinary medical and surgical practice: we have advanced greatly through the instrumentality of this description of knowledge; at the same time, however, we have likewise discovered that there is a great deal yet to be learned, and we are most happy to see that many clever well-informed veterinarians declare themselves fully sensible of this by the ready and effective manner in which they are applying their shoulders to the wheel. Impressed with these considerations, we could not regard the account we are hereafter to give of the disorders of horses but as imperfect, unless we prefaced it with an outline of the anatomy and physiology of the animal: this, therefore, shall engage us in the first instance.

ANATOMY AND PHYSIOLOGY OF THE HORSE.

The *Anatomy* of any animal comprehends a knowledge of the structure of its several component parts; and of the various relations subsisting between those parts. The basis of the animal fabric, the frame-work to which the other parts are attached, and by which they are sustained and protected, is constituted of the *bones:* it is therefore usual, and indeed in accordance with nature, to give the bones the first consideration.

The Bones.

Supposing the bones stripped of the flesh and other soft parts with which they are invested, and yet connected together, either by their own natural ligaments, or, artificially, by means of wires; in that state they constitute a *skeleton;* the study of the mechanism of which it is that lays the foundation of all our anatomy. The plate annexed (Plate DXXX.) of the skeleton of a horse, will convey a very correct idea of the outworks of his anatomy, and at the same time enable us to fill up the outline comprehensibly, and we hope profitably and satisfactorily to our readers. A general view, either of the skeleton or the complete horse, will show, that the entire body, leaving out the head and neck, will come pretty correctly within the limits of a square; a configuration we shall find it useful to remember; because it will at once enable us to form tolerably correct notions concerning proportion. For example, we shall find, on dividing this square, that a horizontal line drawn through its middle will about include the *trunk* within the superior division, the limbs within the inferior: and again, a perpendicular line drawn through the middle of the square will bisect the body into two equal parts, and fall upon a plane ground surface at a point equi-distant from the four points of tread. The trunk, or middle piece of the skeleton, is supported by four columns, the *limbs;* which, though some of their component pieces are placed in different directions, descend in and form, in the aggregate, direct perpendiculars: they support the trunk in about an equal ratio, but the weight of the neck and head descend chiefly upon the fore limbs, in consequence of their elevation upon and junction to the anterior part of the trunk.

We divide the skeleton, in our description, into *trunk*, *head*, and *extremities.*

The Trunk comprises the *spine*, *thorax*, and *pelvis.*

The Spine comprehends the long chain of irregular bones extending from the head to the tail; it is the part vulgarly denominated the *back-bone;* although it no more belongs to the back exclusively than it does to the neck, the loins, or the tail: in fact, of all these parts it constitutes the bony fabric. Its bones, whose number in all amounts to 30, are denominated *vertebræ*, (from *verto*, to turn). Seven of them belong to the neck, and are thence called *cervical;* 18 to the back, and are named *dorsal;* and five to the loins, denominated *lumbar.*

The *Cervical Vertebræ* give form and length and support to the neck. The first of them is connected with the occipital bone (the bone forming the poll of the head); the last is joined to the first of the dorsal vertebræ: the intervening bones are linked one with another. These vertebræ are larger, and admit of more motion between them than either of the other classes; hence it is that the neck becomes a very movable part. A horse can look, and turn his head almost directly, either to the right or to the left, and can also extensively raise or depress his head; and in almost every movement of the head, the neck participates, or rather we may say, is principally concerned in its performance.

The *Dorsal Vertebræ* give form and strength to the back. They are smaller, and have not so much freedom of motion as those of the neck, but are more numerous. They are connected one with another, with the exception of the first and last; and of them, the former is joined to the seventh cervical, the latter to the first lumbar vertebra. They have also attached to them the heads of the ribs, which are received into the cavities formed between them.

The *Lumbar Vertebræ*, commonly *five*, occasionally *six* in number, possess an intermediate magnitude, and indeed facility of motion, between the cervical and dorsal. At the fore end they are joined to the dorsal; at the hind, to the sacral or rump-bone.

The Thorax, or *chest*, includes the cavity formed by the ribs and breast bone.

The *Ribs*, thirty-six in number, form so many parallel bony arches, corresponding in number and form on either side, running from the spine, superiorly, to the breast-bone, which is situated, in relation to them, anteriorly and inferiorly. They form a cavity spacious in proportion to the circularity and depth of their arches, within which are contained organs most important; and it is to form this cavity, and serve to protect the contents of it, that these bones are useful.

The Pelvis is the hinder part of the trunk; it constitutes the osseous basis of the rump, the hips, and the tail. It is composed of eighteen bones, viz. the two hip or haunch bones, the rump-bone, and the fifteen small bones of the tail.

The *Hip-Bones* are the two large bones, whose prominent or uppermost parts form the hips, while their inferior parts are imbedded in the haunches. They are the largest pair of bones in the skeleton: in the joint the butchers call "an edge-bone of beef," one of these is the bone presented to us. It lies upon, and is fastened to, the lateral parts of the rump-bone; and, inferiorly, has connected to it the proper haunch-bones, to which it serves as the pivot or axis of motion.

The *Rump-Bone* is joined to the spine, of which it looks like, and is indeed the natural continuation; although anatomists choose to regard it as a distinct part. It has the appearance of being composed of five pieces, and was originally, but they become by age consolidated. It possesses no motion within itself.

The *Coccygeal* or *Tail Bones*, are continued from the posterior end of the rump-bone; which they very much resemble, only that they are smaller, and that they continue still to diminish from first to last. They vary in number from 13 to 18, in different horses. They admit, altogether, of great variety and extent of motion, which accounts for the multiplicity and facility of movements possessed by the tail.

The Head, the part we shall next consider, presents a quadrilateral bulky form, broad and flattened on the sides, narrow and contracted towards the nose, and for the most part hollow interiorly. It is remarkable for the prolongation and capaciousness of the parts forming the nose and mouth, and for the contractedness of the cavity for holding the brain. It constitutes the anteriormost part of the skeleton; is articulated with the spine, from which it is suspended; and, for the sake of description, is divided into *cranium* and *face*.

The Cranium or *skull*, is, more plainly speaking, the *brain-case*, being the part exclusively devoted to the lodgment of the brain. It constitutes the postero-superior parts of the head; is prominent and convex, superiorly and laterally; hollow and vaulted interiorly. It is composed of ten separate bones or pieces; three in pairs, the others single; viz. one pair of frontal bones, one parietal bone, two pairs of temporal bones, one occipital, one ethmoid, and one sphenoid bone.

The Frontal Bones form the antero-superior part of the cranium, the part we denominate the forehead, and which in the living horse is very commonly marked with a patch of white hair, called a star. This bone is worthy of remark, from the circumstances of its supporting internally the anterior lobe of the brain, and of having two excavations within it, which take the name of the *Frontal Sinuses.*

The Parietal is the bone joined to the posterior side of the frontal. It encases the middle lobes of the brain.

The Temporal Bones, four in number, form the sides of the brain-case. One pair of them are called the *squamous*, because their borders overlap those of the parietal bone, after the manner of a scale; the other, from their hardness, the *petrous portions:* these latter contain the internal organs of hearing, and to them the ears are attached.

The Ethmoid and Sphenoid Bones form what is denominated the *base* of the cranium; the part upon which the brain rests, and to which, anteriorly, are united the bones composing the posterior parts of the face. The former is remarkable for possessing a structure very like a honey-comb, which communicates with the nose; and the latter has two sinuses within it, which also open into the nasal cavities.

The Bones of the Face.—The face constitutes the antero-superior, anterior, and inferior parts of the head, making altogether (including the lower jaw) about four-fifths of the whole; it is the part to which the head owes its prolongation, anteriorly; and its breadth and capacity, inferiorly. It is constituted of two perfectly distinct and separate parts: the *upper* and *lower jaws.*

The *Upper Jaw* is composed of seventeen pieces or separate bones, which are joined, immovably, one to another, after the same manner as the component pieces of the cranium. They are all in pairs with the exception of one: and their names are, the nasal bones; the superior and anterior maxillary bones; the malar; the lachrymal; the palatine; the superior and inferior turbinated bones; and the vomer, which is single.

Our limits will not permit us to particularize these bones, nor indeed is it necessary for the purpose we have in view; we shall, therefore, confine ourselves to a few general remarks on the upper jaw, considered as an integral structure. The first objects which appear to strike us, are the *orbits*, the cavities designed for the lodgment of the eyes. They are formed by the union of four of the bones of the cranium, and three of those of the face.

They are conical in their conformation, their bases being the openings through which the eyes look, and their direction is such that the most extensive sphere of vision is obtained.

The *Anterior Nasal Aperture* is the large vacuity presenting in the anterior and inferior part of the head; around which, in the living animal, the nostrils are attached. It opens into an extensive cavity, divided into two by a middle (gristly) partition; which apartments have free communication with the sinuses on their correspondent sides; and it is the number, capacity, and extent of surface altogether of these nasal cavities that endows the animal with his exquisite sense of smell.

The *Mouth* is the space formed between the upper and lower jaws, varying in capacity according to the degree of their separation.

The *Lower Jaw* consists of a single bone. It is connected with the upper by two joints existing between the temporal bones and its condyloid eminences, by which it possesses very free motion downwards and backwards, and also some degree of lateral motion.

The *Teeth* are common to both jaws. They are the instruments used by the animal for the abscission and manducation of his food. There are three kinds or *classes* of teeth: the *nippers*, or incisive teeth, 12 in number, which are placed in two semicircular rows in front of the jaws; the *grinders*, or molar teeth, 24 in number, which are implanted in four longitudinal rows into the sides of the jaws; and the *tusks*, or canine teeth, four in number, which are placed in the middle of the lateral interspaces between the nippers and grinders, making altogether 40 teeth.

The Extremities are four in number, and are disposed in pairs, viz. two *fore*, and two *hind*.

The Fore Extremities are placed against the sides of the anterior parts of the trunk; from which they proceed downward. Each of them is divided into shoulder, arm, knee, leg, pastern, coronet, and foot.

The *Shoulder* is constituted of two bones; the blade bone, and the humeral bone: the former is broad, and flat, and thin, and is somewhat excavated internally, in order that it may lie in adaptation against the ribs; the latter is a cylindrical bone, and forms a ball and socket joint, superiorly and anteriorly, with the blade bone, and a hinge joint, inferiorly and posteriorly, with the arm bone.

The *Arm* consists, in the adult horse, of a single bone; but in the colt, the arm bone is separable into two. Below, it forms a joint with the knee.

The *Knee* is composed of seven small cubiform bones; six of which are placed so as to form two rows or tiers, one above the other; the seventh is placed behind the others.

The *first row* consists of the scaphoid bone on the inner side; the cuneiform on the outer; and the lunar bone in the middle. The *lower row*, of the trapezoid bone, under the scaphoid; of the magnum, or large bone, under the lunar; and of the unciform, under the cuneiform. The seventh bone, the trapezium, is connected to the cuneiform. The superior row articulates with the arm bone; the inferior row rests upon the cannon and splint bones.

The *Leg* is composed of three bones; the cannon, and the two split bones. The cannon (also called the large metacarpal) is a straight cylindrical bone, about the same length as the arm bone, reaching from the knee down to the pastern, where it articulates with the pastern bone. The splint bones (also denominated the small metacarpal) are two slender pieces attached to the back of the cannon; they aid in the support of the bones of the knee, but do not reach to the pastern, themselves being sustained by the gristly substances which connect them to the cannon.

The *Pastern* consists of the pastern bone alone; a short bone, compared to the cannon, which it otherwise resembles in form. With the cannon, it forms the fetlock joint; with the coronet bone, the pastern joint.

The *Coronet* has for its base the coronet bone; and is, only that it is shorter and somewhat broader, in form exactly that of the pastern bone. It articulates below with the coffin and navicular bones, and thereby forms the coffin joint.

The *Foot* is composed of two bones; the coffin and navicular. The coffin bone is the large one, and has the general shape of the hoof which contains it. It is a very porous and even a brittle bone, and, were it not for its elastic attachments to the hoof, would be quite inadequate to the support of the superincumbent weight. The navicular or shuttle bone, may be regarded as an appendix to the coffin, to the posterior part of which it is attached. Its principal uses appear to be, to serve as a spring to the foot, and to enable the flexor muscles to act with more effect.

The Hind Extremities are connected with the posterior parts of the trunk, which they support. Each limb is divided into haunch, thigh, hock, leg, pastern, coronet, and foot.

The *Haunch* has for its base, inferiorly, the round bone, which is one of the strongest bones in the body. It is cylindrical in form; only possessing, superiorly, a spherical head, which forms a ball and socket joint with the hip bone; also two prominences inferiorly, which form a double hinge joint with the thigh bone. The prominence of this joint, in front, known as the *stifle*, is completed by the stifle bone, which is attached by muscles to the round bone, and by ligaments to the thigh bone.

The *Thigh* is formed by the thigh bone, which in the adult animal is all one; but in the young subject consists of a large bone and a small one, attached to its outer side, very much like a splint bone; the connexion between them being of a gristly nature. The lower end of this bone has a pulley-like connexion with the uppermost bone of the hock; and in this structure it is, that the motion of the hock joint principally resides.

The *Hock*, like the knee, to which it corresponds, consists, not of one or two, but of many small bones—of six: and their names are, the knuckle bone; the hock bone; the cuboid bone; and the large, middle, and small cuneiform bones.

The knuckle bone is the uppermost one; that which presents a pulley-like surface upon which plays the thigh bone. The hock bone is the one which projects behind, forming what is denominated *the point* of the hock; to it the ham-strings are fixed. The cuboid bone forms the outer part of the hock. The three cuneiform bones, all broad and flat, with a circular outline, are placed, one upon the other, between the knuckle and the cannon bone.

The bones below the hock, composing the *hind* leg, pastern, coronet, and foot, are exactly the same, in regard to number and all particularities, as those composing the *fore* leg, pastern, &c., at least, there is only this material difference—that the hind cannon bone is about one-sixth of its length longer than the fore one.

The Muscles.

On dissecting an animal, the fleshy parts prove to be naturally divisible into numerous distinct compact masses, assuming various forms and sizes, which constitute so many *muscles:* and these parts during life are susceptible of spontaneous contraction and relaxation. No movement can take place of any part of the body but what is the effect, either direct or indirect, of muscular action. Most of these motions are subject to the will of the animal, and are therefore called *voluntary;* some parts, however, act in accordance with some particular stimulus, without being entirely or at all subject to the will; and these muscles or muscular fibres are said to be *involuntary:* the heart, the bladder, the stomach, the intestines, &c., are of this latter description. Again, there is a third kind or class of muscles which are described as *mixed*, because their motions can only be influenced, not entirely governed, by the will. The voluntary muscles are about 300 in number; and have all distinct names, denoting their size, their figure, situation, use, arrangement of fibres, or else their places of attachment. Although we have thought proper to make these few general observations on the muscles, it is not our intention to proceed farther; indeed our space will not allow of it, and, even though it did, we have here said as much as is requisite to enable the reader to follow us in our inquiries into the nature and treatment of disease.

The Organs of Circulation.

By these we mean the organs through whose medium and instrumentality the blood is circulated over every part of the body. The source, prime mover, and principal agent of circulation, is the *heart.* This conical organ, which is in itself an involuntary muscle, is constituted of bundles of fleshy fibres, intricately interwoven together, and so disposed as to form four chambers or cavities: two of these are contained within the basis or superior part, and are called the *auricles;* the two others reach downward to the apex, and are denominated the *ventricles.*

For the purpose of conveying the blood over the body generally, we find springing from the ventricle on the left side, a large elastic tube known by the name of the *aorta:* this is the main trunk of the arterial system; the radical from which originate the numerous branches and ramifications of arteries which run and distribute themselves to every individual organ and part of the body, with the exception of the lungs. Besides the arteries, we have another set of vessels, called *veins*, whose office it is to reconvey the blood distributed over the body by the arteries, back into the heart; hence, they exist in and arise from all parts by numerous ramifications, which, by joining and coalescing one with another, at length form branches whose course we can trace, ending continually in others of still larger size, until the whole of them centre in two main trunks which terminate in the right auricle of the heart.

We have said that the aorta sends no branches to the lungs: these organs derive their vessels from another distinct arterial trunk, which arises from the *right* ventricle, one that is called the *pulmonary artery;* the *pulmonary veins*, which return the blood from the lungs, are also a distinct set, and discharge themselves by four trunks into the *left* auricle.

All this may at first appear strange, and even mysterious, but the resolution of it which we are now going to give, will, we trust, make it plainly intelligible; and, in so doing, cannot fail to impress the mind with the wonderful simplicity and beauty of this piece of living mechanism. The heart itself is so contrived and endowed as to be able to operate both as a forcing and a sucking pump: the ventricles, by their contractions, force the blood into the arteries, and give fresh impetus to the column of blood already contained within them; the auricles by their sucking power draw the blood from the veins, and thereby farther assist in the advance of that stream which is flowing into them from the arteries; in addition to which, both the arteries and veins, more especially the former, possess an inherent power of contraction, enabling them to render the heart considerable aid in the circulation of the blood through the body. The course the blood takes, from any given part to that part again, forms a circle, hence the origin of the term *circulation;* and for this reason it matters not in our description where we *make* a beginning; for, in reality, there is neither beginning nor end. We may say, as is commonly done in "describing the circulation," that the blood is forced by the left ventricle into the aorta, by whose ramifications it is conveyed to every part, excepting the lungs; whence it is conducted back by venous vessels into two large veins called the *venæ cavæ*, which pour it into the right auricle. The right auricle discharges its blood into the right ventricle; and this cavity forces it into the pulmonary artery, which carries it through the lungs; whence it is re-conducted to the heart, but now into the *left* auricle, by the four trunks of the pulmonary veins. The left auricle empties itself into the left ventricle, which every time it becomes in this manner filled, contracts and impels its contents into the aorta: thus keeping up a continual supply of blood on which the maintenance of life itself depends.

Blood is sent to every organ and vital part of the body for the purposes of support and repair; and in the young animal, also for the purpose of growth. It preserves every fibre in a state of vitality, of aptitude for action, and of energy and vigour; it fills up wounds, glues broken bones together, &c.; it is the material, in fact, out of which every individual part, without exception, is formed, and renewed, and repaired. At the same time that the blood furnishes the new materials, it becomes the receiver of those that are old or worn out; and also is the medium through which those are conducted to the different excretories. Such are the urinary and perspiratory organs. Moreover, blood supplies what are called the *secretions:* these are the bile, the urine, the perspiration; also, the horn of the hoof, the hair covering the skin, and the horns of the horned animal.

The Organs of Respiration.

From the organs of circulation, we, in the most natural order, pass to the consideration of those of respiration; the two sets of organs being in their economy most intimately connected. We comprise in this class the nasal chambers and sinuses, the larynx, the wind-pipe, and the lungs.

The *Nasal Chambers* form the interior of the part we in vulgar language call the nose; they are the cavities we see into when the nostrils are dilated, or are opened by the hand. The parts we call the *nostrils* are each composed of five distinct movable pieces of cartilage or gristle, to which they owe their shape and substantiality, and by which the skin is prevented from falling into a state of collapse and closing around the openings. The chambers themselves are formed principally of bone (as has already been shown), only the partition in the middle, which divides them, is a plate of cartilage extending perpendicularly from the whole length of the roof down to the floor. What gives this part such a red aspect, which it commonly has, and always under any excitation, is the membrane which lines the chamber, whose blood-vessels, and nerves also, are exceeding numerous. In fact, it is in this membrane, which is a very delicate and sensitive structure, that the sense of smell or scent resides; and it is from the capacity and extent of surface of the nasal cavities altogether that the animal possesses this sense in such high perfection.

The Sinuses of the head, in consequence of their free communication with the chambers of the nose, also add capacity and extent of surface, and being lined by a continuation of the same membrane, they add very materially to the faculty of smelling. One very principal reason for maintaining this opinion, is the fact of the sinuses being remarkably large in all animals notorious for having "good noses;" such are the hound, the pointer, &c.

The Larynx, properly speaking, is *the organ of voice.* it is the part which forms the *top* of the windpipe, is placed at the root of the tongue, and presents its orifice towards the posterior openings of the chambers of the nose, with which and the windpipe it forms one continued canal. It is composed of five pieces of cartilage, connected together by intervening portions of membrane and ligament. Four of these cartilages are occupied in the formation of the sides; the fifth is erected over the orifice after the manner of the lid of a box which turns on hinges; and in fact it is the lid or cover of the larynx, only that it is by its own elasticity always kept open, unless at the momentary interval of time that the animal is in the act of swallowing, when it is pressed down by the food or fluid passing over it, to prevent either from entering the cavity of the windpipe: when any particle perchance does enter, it is said to have "gone the wrong way," and the animal is instantly seized with a fit of coughing. The principal use of the larynx is the production of the voice; which it generates and variously modifies by a faculty derived from its muscles, of contracting and enlarging its orifice, and rendering its borders more or less tense.

The Windpipe is the tube through which the air passes to and from the lungs: the air enters at the nostrils, passes through the chambers, and gains admission at the larynx into the windpipe. This tube, which is a very long one in horses, owing to the length of their necks, is composed of separate circular narrow pieces of cartilage, from fifty to sixty in number, connected together by still narrower intervening portions of ligament. The advantages of this structure are, that it admits of the various motions of the neck without being by any one of them contracted, or even distorted in its calibre; for were such an effect to be produced, every motion of the parts would interfere with the breathing, and some movements even endanger suffocation. At the upper end, the windpipe is united into one common canal with the larynx; at the lower end the tube splits into two divisions, whose respective dimensions are about half of those of the main channel: the right division runs to the right lung; the left, to the left lung.

The Lungs (which butchers call the *lights*) are the veritable *organs of respiration.* Those we have just described being only auxiliaries, in fact, are to be regarded as altogether dependent upon the lungs for the execution of their several functions. There could be no sense of smell, were it not that the lungs inhaled the vapours into the nose; neither could voice be produced unless air was expired through the larynx. The lungs are situated within the cavity of the chest, protected on the sides by the ribs, below by the breast-bone, and separated from the bowels by the muscular partition between the chest and belly, called the *diaphragm* or midriff: the heart lies in the interspace between the lung of the right side and that of the left. The cavity containing one lung is partitioned by membrane from that containing the other, and there is no communication whatever between them; the cavities themselves, however, are so completely fitted and filled by their respective lungs, that there cannot in truth be said to exist any *cavities* at all in the natural and living state. The structure of the lungs is *cellular:* they are made up of an infinite number of minute *cells,* which (cells) receive the terminations of the extreme ramifications of the branches of the windpipe: so that if we impel air or fluid of any kind into the windpipe, the lungs become readily inflated and distended after the manner of a sponge; and this inflation of them it is which, in the living animal, occasions the expansion of the chest, and constitutes the act of *inspiration;* whereas the contraction of the chest produces the successive act of *expiration*, consisting in the expulsion of the air out of the lungs. Air enters at the nostrils, passes through the chambers of the nose, through the larynx, and down the windpipe; here part rushes through the right tube (or division of the windpipe) to fill the right lung, part through the left, to fill the left lung: and having remained for about the space of half a minute within the lungs, it becomes expired to make room for a fresh inspiration. These alternate acts of inspiration and expiration it is which constitute *respiration* or breathing; and life is made so dependent on the regular performance of them that we cannot interrupt the operation, not even for a minute, without threatening the death of the animal. The only connexion we are able to discover between respiration and the support of life, is, that the blood (which circulates through the lungs every time it makes the *lesser* circulation, as we have so recently shown) undergoes while within them a change from a dark modena red to a bright scarlet hue; which change, though it be most perceptible to us in respect to colour, no doubt is attended with the restoration or renovation of some lost or impaired vivifying principle which the blood appears to impart afterwards to every part of the body, in the course of its general circulation.

Organs of Nutrition.

The blood, as we have so recently stated, is to be regarded as the *pabutum vitæ*, as the material out of which every part is formed originally, is repaired, reproduced, and even animated. We have said, that it appears to derive its vivifying principle from respiration: as this however seems to consist only in some peculiar chemical change, adding nothing to its volume, it must be obvious that unless there was some source of supply, the blood would, from the demands continually made on it by different parts, soon decrease and become insufficient to preserve life. This supply is derived from *the organs of nutrition:* and *they* comprehend the mouth, the pharynx, the gullet, the stomach, the guts, the liver, the spleen, and the pancreas.

The Mouth, in most quadrupeds, is of large dimensions, to enable them either to seize with more certainty upon their prey or food, or to subject larger masses of it at a time to mastication. The cavity is constituted of the upper and under jaws, of the lips, and cheeks, and palate; and contains within it the tongue and the teeth, which latter are set in rows around its fore part, and along its sides. *The lips*, by means of a prehensile power they possess, in grazing embrace the herb, which at the same time is seized by the *incisive teeth*, and by them, with a sudden acclination of the head, nipped off and committed to the tongue. In the *tongue* resides the faculty of *taste;* by this organ it is that cognizance is taken of whatever the animal, by first smelling it, takes a liking to; but the flavour is not imparted until it has been mixed with the spittle in the mouth, and, in the instance of grain and such like food, until it has been comminuted and ground down to a pulp, by the action of the grinding teeth. Providing the flavour be such as is grateful, the mastication, which is the office of the *grinders*, is continued; and the food within the mouth is all reduced to a soft mass, and in that state is received by the pharynx.

The Pharynx is a muscular pouch, shaped like a funnel, situated at the root of the tongue, for the purpose of receiving the food as fast as it is masticated and moistened and mixed with spittle in the mouth. It consists of a strong membrane, clothed with several small muscles, endowing it with the power of contracting on the alimentary mass within it, and forcing it onward into the gullet; which action constitutes deglutition or swallowing.

The Gullet (in technical language the *œsophagus*) is a long tube, similar in structure to the pharynx, only of a different form, reaching from the pharynx, down the neck and through the upper part of the chest, to the stomach, in which it terminates. Its office is to transmit the food from the pharynx into the stomach; and to this end it possesses similar powers of contraction to the pharynx, and thereby forces the food it receives from that pouch, onward, to its place of destination. It might appear to some (especially in the case of fluid) that the food worked its way down the gullet by its own gravity; but this is at once disproved by the fact of a horse being able to eat or drink quite as well with his head in a dependent, as in an erect posture: in which case the food absolutely *ascends* to get into the stomach.

The Stomach, the first and chief of the viscera contained within the cavity of the belly, is emphatically denominated *the organ of digestion;* because within *it* that process is begun and matured to a greater degree than in any part of the intestinal canal. It is a membranous bag, clothed with muscular fibres, possessing a power of contraction; and also, internally, of producing a peculiar fluid, called the *gastric juice.* In the horse, the stomach, in proportion to his bulk, is extremely small; on which account he differs from most other animals, in not satisfying the demands of hunger when he has once filled it: with a full stomach, a man or a dog will cease to desire more food, and will lie down and be disposed to sleep; but a horse with a replenished stomach will continue to feed with little less avidity than before. The reason why a horse's stomach was made so small, is, that being an animal of burden and speed, he would have been ill-fitted for such purposes, had not his abdominal viscera have been so sized and constructed as not to interfere with his respiration, on the freedom and soundness of which his strength and action mainly depend. The food, as soon as it is lodged within the stomach, becomes mixed with the gastric juice, and afterwards undergoes a change into an uniform pulpy mass, called *chyme;* in which state it passes into the guts.

The INTESTINES or *guts* consist of many yards in length of membranous tube, folded one upon or around another; through the various convolutions of which the chimous mass, contained within the stomach, has to pass, in order that all its nutritious principles may be extracted before it arrives at the expellent outlet, which forms the termination of the last of the guts, viz. the *anus*. Although the guts form one continued canal from the stomach to the anus; on examining the various convolutions particularly, we find them to be naturally divided into *small guts* and *large guts;* the former coming from the stomach and ending in the latter, which at length terminate in the anus.

The LIVER is placed in the same cavity with the guts; is a dark reddish looking substance, composed of blood-vessels, and an interstitial substance connecting them; and its duty is to furnish the *bile*. By the peculiar operation of its vessels, bile is elaborated or (as we technically say) *secreted* from the blood contained in this gland, and is no sooner formed than it is conveyed by a set of vessels ready to receive it, called *excretory ducts*, into the canal of the small guts, not far distant from the intestinal orifice of the stomach. Here it mixes with the chyme, as the chyme comes from the stomach, and works a second change in the mass, viz. the conversion of it into two ingredients: a milky fluid, which we call *chyle*; and a semi-solid dark coloured mass which is innutritious and designed for expulsion. The chyle is the nutritive ingredient; and in consequence is absorbed from the other part by a particular set of vessels, denominated the *lacteals* (from the milkiness of their circulating fluid), which convey it to one of the large veins at the bottom of the neck, and therein pour it in order that it may circulate with and ultimately become part of the blood itself. In this way it is then, that the food taken in becomes aliment to the body: in this way it is that the blood is recruited after its various expenditures. The chyle having been extracted, the remainder—the feculent parts of the mass, are forced onward by the contractions of the guts through the canal, only becoming more solid in their passage; and when they arrive within the large guts, become by degrees moulded into small and globular masses, such as we perceive the dung-balls to be, and at length are expelled through the anus. And as a horse is, in a state of nature, almost always feeding, so we find that his evacuations are proportionably frequent; in fact, there is a continued elaboration of his food going on within his inside, of the nature we have described, which effectually prevents that condition of accumulation and plenitude which would prove so disadvantageous to him as an animal of speed and burden.

The SPLEEN or *milt*, and the PANCREAS or *sweetbread*, require but little notice at our hands. The former is subservient in its function to the liver: the latter, like the liver, has an excretory duct, which conveys a fluid from it, denominated the *pancreatic fluid*, into the small guts; which fluid exerts some unknown agency in the transmutation of the chymous mass into the chylous and feculent parts.

Urinary Organs.

The organs we are now entering on the consideration of, are those whose function it is to furnish and expel the urine; the benefits accruing from which to the animal economy, we shall inquire into, after we have made some remarks on the structure and arrangement of the apparatus. These organs comprehend the kidneys, the ureters, the bladder, and the urethra.

The KIDNEYS are two dark reddish ovoid bodies, situated in the loins: their form and general appearance, however, are too familiar to need any particular description. They are composed of congeries of blood-vessels (both arteries and veins), and of a peculiar set of other vessels, denominated, from their office, the *uriniferous tubes*. The arteries separate or secrete urine from the blood circulating within them; the uriniferous tubes conduct this urine into a small cavity in the interior of the kidney, named *the pelvis*, and the veins return into the general circulation the unexpended blood. From the pelvis originates the URETER; a single tube which conveys the urine away from the kidney and pours it into the bladder.

The BLADDER is a single bag, both muscular and membranous in its composition; the use of which is to serve as a reservoir or receptable to contain the urine until such time as it is found convenient by the animal to discharge it. Were it not for the bladder, the urine must trickle away as fast as it was produced. At the same time, let it be understood that this continence is limited: although the animal has it in his power to void his urine every half hour, or every second or third hour, he cannot retain it for any length of time after the bladder has once become distended; hence it happens that horses, every now and then, take to discharging their urine at the very time even that they are in action, being by their masters heedlessly ridden or driven onward.

The URETHRA is the pipe or tube which conducts the urine from the bladder through the yard (in the male), through the vagina (in the female), to the orifice from which it becomes discharged. What forces the urine out, is the contractile power of the bladder: the bag being muscular as well as membranous, possesses the power of contracting its dimensions so that it can form either a large or a small cavity; or, rather the power of adjusting its capacity to its contents.

The Organs of Generation.

It will not be necessary to detain our reader long on the present subject: these being parts but rarely the seat of disease. They are, in the male, the testicles, the deferents, the seminal bladders, and the penis; in the female, the ovaries, the fallopian tubes, the womb, the vagina, and the pudendum.

The TESTICLES are the veritable male organs of procreation: in them alone resides the power which can excite the female organs to generative action. They are two oval bodies, loosely lodged within a purse or bag called *the scrotum*, dependent from the posterior and inferior parts of the belly. The foal is said to have no stones: the truth is, that these bodies grow originally within the cavity of the belly, from which they do not commonly descend into the purse before the animal has completed his first year. Like other glands, (such as the liver and kidneys,) they consist of arteries and veins; but in addition, of a peculiar order of vessels, called the *seminiferous tubes*, which carry away the seminal fluid produced by the arteries from the blood, and conduct it into the deferents. *The deferents* are single conduit tubes, one to each testicle, analogous in the office they perform to the ureters: they conduct the furnished semen from the testicles into the seminal bladders.

The Seminal Bladders (*the vesiculæ seminales*), are two pyriform membranous pouches, situated within the pelvis, along side of the bladder, which are (or were) supposed to serve as receptacles for the semen, the same as the bladder does for the urine. They are composed of a fibrous tunic exteriorly, and a papillary membrane internally, from which issues a mucous fluid that is mixed with the semen.

The *Penis* or *Yard* is the instrument by which copulation with the female is effected: at the same time, it serves as a conduit for the expulsion of the urine, as well as the ejection of the semen. The horse (together with several other quadrupeds) possesses a power of retracting the penis within the loose folds of skin surrounding its root, which we call the *sheath;* letting it down only on those occasions when he makes water, or preparatory to erection. In the flaccid or unerected condition, the yard, contracted within its sheath, is nowise remarkable in volume; but in the erected or distended state, it reaches half-way along the belly, and becomes an instrument of very formidable dimensions: the rationale of which is, that it is an extremely extensible structure, possessing the property of evolution, and that in the one case it is filled to distension with blood, while in the other its cavities are empty. The composition of the organ is *cellular*. It consists of two cylindrical membranous tubes, whose interior is similar to a sponge, cellular, into which certain arteries pour their blood, and from which corresponding veins take the fluid up again: it being only at certain times, during the interval of sensual excitation, that the arteries are stimulated to infuse blood faster than the veins can carry it away, which accelerated influx, by causing accumulation, accounts for the distension. There is yet a *third* part entering into the composition of the penis; and that is the *urethra*, the canal which conveys the urine away from the bladder to be discharged. From its being muscular in composition, it possesses the power of expelling the urine in a forcible stream: the same power also enables the organ to ejaculate the seminal fluid into the womb of the female.

The Organs of Generation in the Female constitute, altogether, a more complicated apparatus than those we have just been considering. We shall commence with the *external parts* of them—those exposed to view; and from them proceed to the *internal parts*, which lie concealed within the body.

The *External Orifice*—the *vulva*, (quasi *valva*,) as it is technically denoted, is a broad longitudinal fissure extending down between the posterior parts of the thighs, removed a short distance only from the anus, above it. The prominent doublings of the skin, forming the sides of it, are designated the *lips*, the *labia sinus pudoris*. The orifice itself leads into a spacious canal, which is

The *Vagina;* the direct channel to the womb, also one which receives the termination of the *urethra* in the female, in its way from the bladder outwards. So that the external orifice becomes the common outlet for urine and discharges from the womb, at the same time that it is the part through which the female has connexion and becomes impregnated by the male: it afterwards serves also for the transmission into the world of the fœtus. Hence we see the necessity for its being a passage of large dimensions, and one that possesses a very extensible texture.

The *Uterus* or *womb* is situated within the cavity of the *pelvis*, or lower belly, in unison with the internal end of the vaginal canal. It has a peculiar form in the mare; consisting of a single bag or middle part, from which extends forwards two tubular portions or *horns*, as they are denominated. It is the posterior end of the middle bag which is connected with the vagina; but the connexion is not one of simple canal: the womb at this part exhibits a prominence, with a small pouting orifice in the very middle of it, known as its *mouth;* and both mouth and prominence altogether are inclosed within the vagina. Being muscular, as well as membranous in its composition, the womb possesses the power of contraction, by which it is that it becomes able at the proper season to expel its fœtus.

The *Ovaries* or *female testicles* are two egg-shaped bodies, situated within the posterior part of the belly, at the distance of one or two inches from the extremities of the horns of the womb. They are about the magnitude of walnuts, but have deep fissures in their posterior parts. They are composed of a whitish spongy substance; and in their interior, in some instances, are found one or more little vesicles containing a yellowish glairy fluid, while in others only dark yellowish spots are detectable: the explanation of which is, that the ovaries are the organs containing the germs or rudiments of the future beings; that these vesicles are supposed to be germs; and that, after impregnation has taken place, and the germ in consequence passed into the womb, the cavity fills up with a substance which gives it the appearance of a yellowish or brownish spot. We find the *ovum* (as the impregnated germ is called) is conducted from the ovary into the womb by the *fallopian tube*—a serpentine canal, equal in calibre to a crow quill, running, one on each side, from the place where the ovary lies to the horn of the womb: these tubes, from their smallness, and from being enveloped in loose membranous coverings, require an able anatomist to demonstrate them.

By the act of coitus the female becomes impregnated: the seminal fluid issuing at the time from the male organ, is received through the mouth of the womb into its cavity, and thence is supposed to pass onward through one of the fallopian tubes to the ovary; upon which it has such an effect, as to cause an irruption in some part of it, and the consequent disgorgement of an ovum; which ovum is received by the same tube, and conducted into the womb. Here it imperceptibly, during growth, assumes the form of the animal it is designed to represent: and on the eleventh month from the time of conception, is found to have attained that perfection which fits it for an independent existence; and now the womb yields up its charge, *i. e.* the fœtus becomes expelled by contractile power through the vagina, and out at the external orifice. Such is the mysterious process observable in the reproduction of the species.

The Organs of Sensation and Perception.

By the faculty of sensation, animals obtain a knowledge of what is passing around them, and, to a certain extent, become conscious of what is going on within their own bodies: the more perfect animals possess certain perceptive or sensitive faculties, which, though not necessary to their existence, render their lives more agreeable to themselves, and more useful to man. All this emanates from the brain and nerves.

The Brain. Of all animals, man, in proportion to his size, possesses the largest quantity of brain: in horses especially, the organ is comparatively small. It is inclosed within that part of the head we call the *cranium;* by which it is on all sides well protected. The entire mass is divided into three distinct portions: the *cerebrum*, which constitutes about three-fourths of the whole, and occupies the anterior and superior parts of the cavity; the *cerebellum* or little brain, which is placed below and behind the cerebrum; and the *medulla oblongata*, or oblong and smallest portion, placed still lower than the cerebellum. There is also a *fifth* part, which may be regarded as, and is in fact, a continuation of the medulla oblongata, although anatomists choose to consider it separately: this is the *spinal marrow*, which occupies the spinal or vertebral canal, running through the neck, back, loins, and croup. The brain has three coverings or *meninges*, named the *dura mater*, the *pia mater*, and the *tunica arachnoides;* which last is the middle one. If we cut into the substance of the brain, we perceive that it is composed of parts of different colours: the dark portion—that which has a dirty cineritious hue, is denominated, from its being outside, *the cortical part;* while the white or internal portion is called *the medullary.* In a physiological point of view, the brain is to be regarded as the source or seat of sensation; hence it is often described as *the sensorium.* Injury to the brain, short of producing death, is followed by a state of general insensibility; and, furthermore, the body is rendered incapable of moving itself: for voluntary motion being one of the effects of sensation or perception, it is with the destruction of that faculty also lost.

The Nerves are so many sensitive cords of communication between the brain or spinal marrow and the several organs of the body; by whose agency sensation or volition, or both, variously modified, are maintained. If the nerves going to any voluntary part—say the fore-leg—be cut through, the limb will be deprived not only of all sensibility, (so that one may cut or burn it with impunity,) but also of all power of motion, so that the animal has no longer any use of it. It is on this principle that the operation of neurotomy (*nerving*, or rather *unnerving*, as it consists in *dividing* the nerves of the leg, at or about the fetlock or pastern) is practised: the disease being in the foot, the pain is no longer felt by the animal after the communication between the foot and the brain is cut off by the division of the nerves going to the former; and as the pain was the cause of the lameness, the one being removed the other in course ceases.—Nerves in general possess what is denominated *ordinary* or *common* sensitive powers, by way of distinction from certain faculties or peculiar powers possessed by a certain few, *e. g.* the nerve running to the eye, whose name is *the optic*, possesses the faculty of vision; it is impressible to, or susceptible of *light*, and by that property enables us to see; it is the same with *the auditory nerve*, which runs to the ear,—that can *feel* sound, but not light; again, *the gustatory nerve*, running to the tongue, can taste; but it can neither see nor hear. We shall conclude this sketch with some general observations on the anatomy and physiology of the foot; a part of very great importance, no less in an economical than a medical point of view.

The Foot.

"No foot, no horse," is a quaint old adage forcibly impressing us with the truth of this asserted importance of the organ we are about to enter on the description of; for as man values the horse on account of those powers of *action* which enable him to transport his burden from place to place with more celerity, safety, and ease, than any other known animal; so, unless his feet be sound, must this faculty be more or less impaired, and consequently the animal be considered in the same degree diminished in utility; and because in utility, in value.

The foot is composed of bones, cartilages, ligaments, sinews, membranes, and some peculiar elastic substances; and the whole is enclosed within the hoof.

The Bones are the coronet and coffin bones, and the shuttle or navicular bone. We have already given a description of them; and therefore we shall here merely repeat, that between them two joints are formed; the pastern joint and the coffin, both of which are intimately concerned in the motions and functions of the foot.

The Cartilages of the foot are the two broad concavo-convex plates of *gristle* attached to the sides and wings of the coffin bone. Each of them sends a projecting portion round to the point of the coffin bone, which, by means of an intervening fibrous expansion, becomes united with the extensor tendon. About one half of the cartilage, from its breadth being greater than the height of the coffin, rises above the hoof, and is very perceptible to the fingers at the side of the heel, in the living horse. In fact, the cartilages give breadth and form to the heel, and include a space between them which is occupied by the sensitive frog.

The SINEWS or *Tendons* of the foot are, the one belonging to the extensor muscle, which is implanted into the summit of the front of the coffin bone; and that belonging to the flexor muscle, which is inserted into the inferior and posterior part of the same. By the action of these muscles it is that the foot is made the instrument of progression; by the extensor, the limb is extended and the foot projected forward: by the flexor, the limb is bent and the foot carried upwards and backwards. These sinews are so placed as, at the same time, to afford considerable protection to the coffin and navicular joints; and thereby also to add much to the mechanical strength of these parts.

The *Peculiar Elastic Substances* comprehend the sensitive laminæ, sole, and frog.

The SENSITIVE LAMINÆ are those red membranous slips which envelop the front and sides of the coffin bone, running in parallel lines from its superior to its inferior border. These folds or slips or *laminæ*, as they are called, appear to be derived from the coronary ligament; the part that forms the prominent circle to which we give the name (in the living animal) of *coronet*. They are commonly about 500 in number, longest in front, diminishing towards both sides; and are of a ligamentous texture. They are for the purpose of being fitted in between—dove-tailed—with the horny laminæ, by which a most extensive surface of connexion is established between the foot and hoof, thereby making the union so firm and durable, that the weight of the animal is absolutely supported thereon. To the common observer it may appear that the sole, (the bottom of the foot,) in consequence of being the part which is opposed to the ground, must be the part which sustains the superincumbent weight; no such thing—it is the laminæ which support the burden; and, as a convincing proof of it, if the sole be drawn and altogether removed, the animal still treads and rests his weight as firmly as before, although nothing now remains to bear the sensitive foot off the ground but its suspension by the laminæ.

The SENSITIVE SOLE is the red, vascular, fibrous substance covering the concave or ground surface of the coffin bone. It is a remarkably close, firm, strong texture; and presents numerous little villous eminences, which, by being received into pores in the horny sole, establish a firm and almost inseparable connexion between the two. It is also a part which is very full of blood-vessels; so that in paring out the foot, should the knife by any chance wound the sole, it bleeds very freely; hence, also, it is that, in disease, it is often the part chosen to let blood from.

The SENSITIVE FROG is the cuneiform substance occupying the space between the cartilages, partially cleft through the middle of its inferior surface. It is of a gristly and ligamentous nature; and has been supposed to contain *fat*, and hence was named the *fatty* frog. This, however, has been long found to be an error. It may be said, veritably, to be an elastic cushion; impressible on every side, but on none yielding without having its volume augmented in some other direction; so that, as a whole, it may also be said to be *incompressible.* The flexor tendon runs over its superior surface. The horny frog receives its partially cleft bottom; and (as was said before) the cartilages form its two lateral boundaries.

The HOOF is the horny case or covering which nature has provided for the protection of the parts we have just been examining; it may be said of itself to constitute a shoe or defence, enabling the animal in the wild state to move about in quest of food without running any risk of injuring his foot. Anatomically regarded, the hoof is the part which corresponds to the human nail; it can, however, in no other or essential relation, be looked upon in so unimportant a point of view. The general figure of the hoof is conical; but the cone is an inclined or oblique one, and is obtruncated; so that it is altogether rather the section of a figure approaching to a cone. Hoofs are either black or white; or of some intermediate aspect—marbled or striped. The blackest hoofs are commonly preferred; and there seems to be some reason for this preference: on the same principle that white legs are said to be the most prone to failure and disease. Some attention should also be paid to the *size* of the hoof; but more still to its form or *shape.* A small foot is very commonly a *contracted* foot; a large one is as often a *flat* foot; either of these constitutes deformity; and if not themselves the effects of disease, are very likely to prove its forerunners. They are both, therefore, objectionable.

One would suppose, to look at the hoof, even in its detached state, that it formed one entire and inseparable piece: this, however, is not the case; by putrefaction or maceration, or coction, it is found to be naturally divisible into three parts:—wall, sole, and frog.

The WALL or *crust* is all that part of the hoof which we see while the horse is standing: it forms the circular or boundary wall to the parts within. It is composed of longitudinal fibres, which descend in parallel lines from the coronet to the ground surface, and there unite with the surrounding border of the sole. It is about half an inch in thickness. It is broadest in front; gradually decreasing in breadth towards the heels; where, instead of terminating, it is continued on along the sides of the frog, between them and the sole; thereby forming the *bars.* On its internal surface, the wall is lined with *laminæ;* which, though horny, are similar in number, form, and arrangement to those we have lately described—*the sensitive laminæ:* the two sets being, as we stated before, interjoined in such a manner as to form a bond of union capable of sustaining the animal's weight. And furthermore, these laminæ, both sensitive and horny, being elastic substances, will and do, every time the foot comes to the ground, stretch and elongate, and again recede or contract as soon as the force or weight which stretched them ceases to operate; whereby they become most serviceable as a *spring* to the animal; rendering his movements facile and agreeable both to himself and to his rider, as well as free from the danger of fracture or rupture, or other injury to the soft and organised parts of the foot.

The **Horny Sole** is the part which covers the sensitive sole. It is surrounded and embraced on every side by the wall; which projects, inferiorly, beyond it, in order to take off from it all bearing upon the ground. It is an arched plate of horn, having the frog let into the middle of it, between the bars, in the form of a wedge. Its circumferent border constitutes about two-thirds of a circle. Its longitudinals exceed its transverse dimensions: its greatest diameter is a line extended from either heel, obliquely across the middle, to the point opposite, in the toe. It is much more arched in some feet than in others: in some particular feet it is perfectly flat; this, however, is rather to be regarded as disease than as natural form. Its general thickness may be rated at about one-sixth of an inch. It is fibrous in its composition; but its fibres, contrary to vulgar supposition, run directly outward or downward from the sensitive sole; having their ends opposed to the wearing or ground surface.

The sole, as well as the crust, is a part possessed of elasticity; and also one which (though not to the same extent) serves the end of a spring. Every time the laminæ are put on the stretch, the coffin bone is pressed down upon the sole; the sole itself then yields, and yields by becoming flat (or flatter than it was before), and consequently at the same time dilates, and so forces out the surrounding border of the wall which embraces it: afterwards, the pressure being taken off, it again springs up and resumes its former (concavo-convex) shape.

The **Horny Frog** is that prominent, cuneiform, spongy body which is received into the chasm between the bars, left by the recession of the sole; with both which parts it is united; it is also firmly embraced by the heels of the crust. It has very much the shape of a ploughshare; being cuneiform, elongated, pointed in front, and broad and bifid behind. Its surfaces, upper and under, are the counterparts of each other: the upper is made to receive the sensitive frog; the lower one has a cleft in the broad part, the same as the sensitive frog itself. Although this part is also horny, yet its texture differs remarkably from that of the crust or sole: it has a soft, spongy, India rubber sort of texture, and is found to be of a nature highly elastic *of itself*, independent of the great elasticity it derives as a body from its situation and connexions. Although it is situated within—indeed, forms a considerable part of the tread of the foot, yet it is not placed directly under the line of pressure of the superincumbent weight of the animal; it is, at least the greater part of it is, behind this perpendicular; and consequently does not receive the brunt of the weight, although it will be found to receive no considerable share of it. The fact is, that the navicular bone, which is situated behind the coffin, is impressed but with a *proportion* of the weight from above; and this proportion it is which is transmitted to the frog. Now, the horny frog is meant to take a secondary bearing upon the ground, in order to prevent the soft or sensitive frog from being pressed (too low) out of its place, also to give resistance from below to the pressure, to the end that the incompressible matter may be made to expand at the sides and drive out the cartilages; which, again, in their turn (the pressure being removed), spring into their places, and press the frog up into its original station. Thus, the laminæ elongate; the sole, and crust surrounding it, expand; the horny frog descends; the elastic one dilates and drives out the cartilages; and elasticity restores them all to their original forms and places.

Shoeing.—The artificial surface upon which the horse is made to tread in the performance of his labour—roads and pavements of various descriptions—requires that his feet should be furnished with some artificial defence; otherwise his hoofs would speedily wear away, exposing the quick or sensitive parts of the foot, and rendering him so lame that he becomes perfectly useless. In some countries—in the sandy deserts of Arabia, for example, no such defence is said to be requisite, at least for ordinary purposes; indeed, even in our own country, we may ride some horses for weeks and months together, with only sufficient shoe to cover the toe of the hoof, the part most subjected to friction and fraction.

It appearing then indispensable that a horse for use should be shod, it becomes a question of some consideration what sort, kind, or description of shoe he ought to wear. This question may be at once answered in a general way, by saying that the shoe should be of that kind which would least of all interfere with the internal mechanism and functions of the foot, at the same time that it serves every purpose required of a shoe, or defence to the hoof. A shoe made of any elastic, flexible, or yielding material, possesses many advantages over one of an opposite description, because it allows of the expansion and contraction of the hoof; but, then, such material is found by experience not to be adequately substantial and durable. A leathern shoe would hardly last for a single journey; and even if it were durable, it would be found wanting resistance sufficient to guard against fracture of the hoof. To conclude, concerning *materiel* for horse-shoes, there is one more (and an important) consideration, and that is, *price*.

Under all these circumstances and considerations, iron has almost universally become the material employed for the manufacture of horse-shoes; and although manifold alterations, and some improvements, have taken place in the form and construction of the shoes, iron is still, at the present hour, the substance of which all are made. The only improvement that has been made in this branch of the veterinary art, is the late introduction of malleable cast iron shoes; and it certainly has every appearance of being one which merits our serious attention.

Having determined on the material, the next consideration is the construction of shoe proper for ordinary or general purposes. The one used in our own country is represented by Fig. 1. Plate DXXXI. It consists of an incomplete ring of iron, one inch in breadth, and three-eighths in thickness, and accommodated in curvature to the circularity of the outer border of the hoof; it is somewhat broader and thicker at the toe than at the heels, and is twice as thick around the external border as around the internal; and is perforated on either side by four nail-holes, three-fourths of an inch apart, one from the other, which should approach nearer to the point of the toe than that of the heel. The nail-holes may be either of themselves counter-sunk, or they may be included within a groove made in the shoe, called the *fullering;* the head of the nail being, in either case, protected from undue wear, as well as from fracture of the neck. The ground-surface of the shoe is made perfectly flat; the foot-surface is gradually bevelled off from the outer to the inner edge, which will leave the internal border of the required thickness, viz. half that of the outer: this is represented by Fig. 2. At least, this appears to be the more common form given to the foot-surface; but the improved, and certainly preferable one, is that which constitutes what farriers call the *seated shoe.* It consists in a shoe having the same ground-surface, with the foot-surface formed into a plain, flat, narrow border all round, from which slopes to its internal edge, a scooped-out or excavated part, making up the remainder of the breadth. The surface at the heels, however, extending forward about one and a half inches from their points, is made altogether flat, and preserves the thickness of the outer border. *Vide* Fig. 3.

The nails used by us are from one to two inches in length, slender, conical, with flat sides, and gradually tapering from the head, which forms the base, to the point or apex of the extended cone. *Vide a, b, c,* in the Plate.

The most ordinary deviation from the common shoe is the *tip;* a shoe of the same make and shape, but one that covers only two-thirds of the border of the hoof, leaving the heels uncovered and free from any restraint whatever: in which consists its principal advantages. It is a shoe that should always be employed while horses are turned out, either at grass or straw-yard; and one that may, in cases of high, strong, and contracted feet, be used with equal advantages on the road. *Vide* Fig. 4.

The principal objection to the (common) long shoe is, that it confines or binds the hoof, very much limiting, or altogether preventing, its expansive spring while the foot is in action; and in order to remedy this (certainly, a serious) evil, a shoe with hinges at the toe has been proposed: and a great deal has been said and written in its favour. It must be perfectly obvious, however, to the meanest understanding, that unless a shoe is so constructed that its properties of motion *harmonize* with the movable faculties of the hoof—if one possesses motion only at one or two points, while the other can more or less expand at every point of its circumference, and more at some than at others, I repeat, it must appear clear enough to any body, that the contrivance is far too imperfect to be of any practical benefit; and moreover, if such a shoe really possessed any such advantages, there are disadvantages attending its application which more than counterbalance them. The shoe here alluded to is represented by Fig. 5, and is denominated the *joint-shoe.*

The French Method of shoeing has been much extolled by some of our veterinarians; and, in some respects, with reason enough; in others, more, it would appear, for the sake of fashion and novelty than real advantage. The French shoe (*Vide* Fig. 6) is rather broader in the web than ours; it is equally thick at every part; the foot-surface of it is concave, the ground-surface convex, and curved upwards at the toe, in order to give the limb, what the French call "*the adjusting balance.*" Altogether, the shoe itself is certainly, in many respects, an objectionable structure, when compared with our own; and in no respect is it more so than in the curvature which is given to the toe of it; the principle of which is false, unnatural, and injurious. The French mode of nailing their shoes upon the feet, however, is one deserving our attention, both from the facility with which it is practised, and from the preservation which it affords to weak, brittle hoofs, which, by our method, are too frequently done injury to. The holes in the French shoe are punched in that direction which (instead of penetrating the crust longitudinally—in the direction of the fibres of the wall, as in the case in English nailing) give the nails an oblique direction forward as well as upward, by which they not only get a stronger hold, but a more secure one, and are more certain in their issue,—their points making their exit but a little way above the shoe itself. This method of nailing, however, is not confined to the French: it forms part of every continental system of shoeing.

The Persian, Turkish, and Arabian shoes bear a common resemblance one to another—Fig. 7 may be regarded as the examplar of them, all three. It consists of a thin plate of iron, which is said to be hammered into form without being heated. It has a small circular hole in the middle; were it not for which, it would entirely cover the lower surface of the hoof. The outer surrounding border forms a projecting edge downwards; and along its inner circle are eight nails, ranged in fours, laterally, and rather near to one another. Furthermore, the shoe has a curvature both at toe and heel.

The Barbary shoe differs but little, and very unimportantly, from the Asian productions. The striking character of it is, that the hole in the middle, instead of being circular, is triangular. (*Vide* Fig. 8.)

The next shoe we think it worth while to offer any remarks on, is the *Bar-shoe,* as it is called. It would appear to have been originally taken from the Asian shoe, to which it still bears some similarity. (*Vide* Fig. 9.) Its use, however, with us, is confined, almost exclusively, to feet in a state of disease. In cases in which we require much pressure to the frog, and liberty to be at the same time given to the heels and quarters, (such as those of contraction and thrush,) the bar-shoe is proper; and particular care should be taken that, in its application, these two designs are fulfilled—by seeing that the shoe is bent up behind sufficiently to come in close apposition with the frog, at the same time that it is so bevelled off at the quarters and heels, that those parts do *not* touch the corresponding parts of the hoof.

In convalescent lameness, when the limb has grown stiff and shrunk from a state of long-continued inactivity; or, in other cases, requiring one limb in particular to be put into action, we employ a contrivance called the *patten-shoe*, which is put upon the fellow or opposite foot: thus, supposing the off fore leg to require extra bearing or action, we apply the patten-shoe to the *near* fore foot. (*Vide* Fig. 10.)

Various kinds of what are denominated *screw-shoes* have been from time to time offered to public notice; the design of which is, by mechanical force, to restore hoofs to their original form, which have become narrowed and deformed by contraction. This is an operation, however, which requires much judgment and precaution, otherwise harm in place of good may result from such an artificial proceeding. Strong hoofs alone should be subjected to the operation; and they, prior to the application of the shoe, should undergo saturation, by long-continued immersion in cold water, in order to render them soft and flexible. The best description of screw shoe is represented by Fig. 11.

To conclude the subject of shoeing, it may be thought strange that we have not hinted a syllable about *hind* shoes. The fact is, that almost every variety of shoe applicable for a fore-foot, may be made useful for a hind-foot; and yet, notwithstanding this practical axiom, the *ordinary* hind-shoe differs in several material points from the common fore-shoe. It is (or rather *ought to be*) a square-toe shoe, narrower in the web than the fore-shoe, with the inner circumferent border equally thick with the outer. The outer heel should be *turned up;* the inner, not; but then the thickness of the latter should be so augmented in every part that the foot may still preserve its equilibrium. Fig. 12 will serve to illustrate what we mean.

DISEASES OF HORSES.

Any body unaccustomed to horses would be very likely to run away with the notion, that, as *animals*, they were seldom, or hardly ever, the subjects of disease, unless it happened that they perchance received any bodily injury from violence or mal-treatment; and such a person might feel disposed to doubt the veracity of the author of this article, when he states as a fact, that, generally speaking, in a regiment of cavalry, taking man for horse, the deaths of the animal much exceed those of the human beings every year. The mind in which a fact, so notorious in the army, excites any surprise, will naturally, here, feel desirous to learn what can be the cause of this. The answer is short, simple, and undeniable. The mortality is owing, primarily and principally, to the pernicious system of recruiting horses at such immature, growing, and tender ages as two and three years old; to their being taken from pasture or strawyard, or other exposed natural and salubrious situations, and placed and pampered in warm, or (as they are falsely called) *comfortable* stables. This is a fact as demonstrable from the most unlimited field of observation, as that two and two make four—a truth as broad and clear as the sun at noonday; and yet is the baneful practice to this day persisted in.

What adds to the mischief resulting from this precocious and unnatural domestication is, that the period of life at which it is instituted is, with the animal, a *critical* one, *i. e.* it is one at which certain revolutions are taking place in his constitution that render him more obnoxious to disorder, and less able to withstand its ravages when once established: hence it is that in young horses diseases are rapid in their progress, more so than in old horses; whereas our remedies in both instances are remarkable for tardiness of action.

One more circumstance, bearing on *causation of disorders in general*, remains to be stated: and that is, that our principal horse-fairs, the marts where the dealers purchase their "young fresh horses," are held during the vernal and autumnal seasons of the year; seasons at which all animals are more or less (but in a special degree the young horse is) predisposed to constitutional disorder. This is the period when the colt is about ceasing his growth and beginning to furnish—to turn, in fact, into a horse; the time when he is about inheriting his powers of propagation, the time when he is cutting his teeth; the time he is changing his coat; the time he becomes most subject to contract strangles, a disorder that may be compared, in some respects, to the pock or measles in children. Such are the shoals and quicksands which that horse-proprietor must labour to avoid, who would conduct a young horse through his *minority*, free from probable and fatal disorder.

We may, conveniently enough for our proposed method of procedure, make a classification of all the diseases into *general*, *constitutional*, *local*, and *specific*.

A general disorder is one which pervades the whole system *in general*, i. e. without (to observation at least) affecting any individual organ or order of parts in particular.

A constitutional disease is one also in which the system is disordered, but to which a local or particular seat is at the same time palpably or presumably assignable.

A local disease is one affecting some single part or place by itself, without disturbing the system.

A specific is a constitutional disease, in which some virus or poisonous matter is supposed to be circulating in the system. All infections and contagious maladies come into this class; though all specific diseases are not contagious.

An animal body may be compared to a very complex machine, the construction of the different parts of which are, as far as we can examine into them, of inimitable apparent simplicity, considering their wonderful operations; and possessed with great resistent and self-repairing powers, considering the abuse to which it is continually exposed. In *health*, every part of the living machine is supposed to be perfect; or at least perfect to such a degree that its functions continue to be performed with sufficient regularity and energy to maintain that state: in *disease*, their harmony of operation is destroyed or deranged, either in consequence of the disorder of one part, or set of parts in particular, or of some unknown influence existing in the system which disarranges, more or less, the action of the whole. It is this derangement of the system which is meant to be understood by the term "fever:" the only *general* disease to which the horse can be said to be subject. For it is not our intention here to dive into the abstruse question, whether there is or is not in nature a disease that can, in this sense, be denominated *general:* some pathologists supposing, and perhaps rightly, or at all events, reasonably, that every disorder must have "a local habitation," and accordingly ought to have a definite name; and so, likewise, will *fever*, when the period arrives at which these *practical* reasoners shall have made us acquainted with its *seat*.

First Class.—General Diseases.

FEVER.—Here again, were we disposed to be captious, and our limits would admit of it, we might enter into a lengthened argument to prove that the horse really was at times the subject of spontaneous fever, technically termed *idiopathic*, by which is meant fever arising in the system without any apparent or detectable cause: but no! we shall cut the matter short by saying, that we meet with such cases; and by referring those who may feel desirous to pursue the inquiry to PERCIVAL'S VETERINARY WORKS.

The fever of a horse is the common or simple inflammatory fever of a man; and its presence is recognised by the following signs or *symptoms:*—The horse appears dull and heavy; hangs down his head and moves sluggishly and aversely; he feels cold, in particular his legs and ears are so; his coat stares, and his skin may have been observed to shiver in places: these constitute the primary or precursory symptoms, and are not invariably present. They are succeeded by the more essential ones;—preternatural warmth in the skin and tangible internal parts, and sometimes even in the hoofs,—mouth dry, tongue furred; quick pulse; breath drawn with unusual movement of the flank, (but not pains fully or quickly, for that would denote another disorder;) increased irritability, so that the least noise or unusual sight alarms him and quickens his pulse and breathing. To these may be added, loss of appetite; costiveness; urine scanty, and often discharged. Fever may commonly be referred to change of temperature: never from heat to cold; but from open situations into warm stables. High feeding and confinement have also some share in its production. On occasions, it is induced by over-exertion. Should the fever run high, it is proper to bleed the animal as soon as possible; but it is seldom requisite to draw more than from two to four quarts of blood: ordinary cases require no bleeding. Mild laxatives are always called for: the best febrifuge medicine is a ball composed of one dram of Barbadoes aloes, ten grains of calomel, one dram of antimonial powder, and half an ounce of nitre, made into a mass of proper consistence with syrup of ginger or some aromatic confection. Should the pulse beat very quick, and the bowels appear much confined, this ball ought to be administered twice a-day; and, as soon as the excrement becomes soft, followed up by a ball composed of half a dram of the powdered root of white hellebore, made up with aromatic confection. Should the legs take to swelling, which they are very apt to do, as the fever abates, the cure may be completed by a diuretic ball daily, and walking exercise, (*in hand*,) regulated by the strength of the patient.

The fever we have been describing may, as we have stated above, either arise spontaneously and exist without any apparent or discoverable local malady, or it may owe its origin and continuance to some lesion or disease of some part or organ in particular. In the latter case, it is called *sympathetic fever*. In either case, however, the fever presents the same phenomena; and, as far as regards its nature, *abstractedly*, requires similar treatment.

2d *Class.—Constitutional Diseases.*

We shall now pass on to the constitutional diseases; and first of those affecting the circulatory system.

The CIRCULATORY SYSTEM, (by which is meant those organs which circulate the blood, viz. the heart and blood-vessels,) in the horse is characteristic for vigorous though comparatively slow action in health; and in disease, for the rapidity and pertinacity with which it pursues the destructive process. It is this disordered action of the blood-vessels which is signified by the term *inflammation:* an action which, of diseases in general, may be said to constitute the essence; while of those few into whose nature we cannot, demonstratively, say it enters, we have but comparatively obscure notions.

We shall first, under this head, make a few remarks on blood-letting, and then proceed with the diseases.

BLOOD-LETTING in the horse is for the most part a simple operation, and one unattended with danger; hence the practice among farriers, grooms, and horsemen of all denominations. The vein running along the side of the neck, from the head to the chest, called the *jugular*, is the one commonly selected for the purpose, both on account of its volume and its superficial situation. Nothing more is required, to open it, than to make pressure with the finger just below the place where it is intended to apply the phleme, and as soon as the vein is distended by the current of blood coming from the head, and is perceptible under the skin, to direct the blade of the phleme towards it and give the blow with the blood-stick. Sometimes a *lancet* is used. It is not so good an instrument for general purposes as a phleme: its utility consists in its being more convenient on particular occasions than the phleme, as in opening the vein of the thigh or arm; also in its being more portable.

Now and then it will happen that the animal will get what is called by the vulgar, "a bad neck," in consequence of being bled. The place will take to swelling all on a sudden, and present a globular tumour as large, perhaps, as one's fist. This arises from the escape of blood underneath the skin, and will require nothing more than a vinegar-and-water lotion, and some aperient or diuretic medicine internally to disperse it. What is of far more consequence, is the tumefaction which takes place some days after the operation, and runs in the form of a chord towards the head: the orifice of the wound made by the phleme, at the same time opening and issuing forth a little ichorous or purulent matter. This will require fomentations, frequent and long continued, and vinegar-and-water lotions in the intervals. Also apply the actual cautery, or a caustic composed of powdered blue vitriol and sulphuric acid, to the wound; and give the horse a strong dose of purgative medicine:—viz. one ounce of Barbadoes aloes, combined with syrup of ginger. Should the swelling grow hard and insensible, it ought to be blistered.

The Heart, the organ by whose propellent power the blood is forced through the blood-vessels over every part of the body, is but rarely itself the seat of disease. Dropsy of the pericardium or heart-bag is occasionally met with: it is mostly, I think, an accompaniment of *hydrothorax.*

The Blood-vessels are more the subject of disease. *Aneurism* has been met with: about half a dozen cases stand on record. *Blood-spavin* is rather a familiar disorder. It consists in an enlargement or dilatation of the vein, which passes over the inner and anterior part of the hock; occasioned by the pressure and consequent partial obstruction in its canal, which the vein receives from a dropsical tumour (which is the same as a windgall) underneath it; viz. one of the *bursæ mucosæ,* as they are called, or bags of joint-oil, which belong to the hock-joint. But a blood-spavin causes no pain or lameness, and therefore cannot be regarded but as an eyesore. Should it, on this account, be considered objectionable, the parts may be blistered; or lightly fired first, and blistered afterwards.

Diseases of the Organs of Respiration.

Of all sets of organs, these are the most prone to disease in animals in general, and particularly in horses and dogs; and of all the diseases those we are about to consider are the most insidious in their approach and progress; the most destructive in their effects. Every act of exertion you put the animal to, calls for "*wind;*" and it will depend on the soundness of these organs whether he can well or ill answer that call, and perfectly or imperfectly perform the act required of him.

Catarrh, the technical appellation for what is vulgarly called "a cold," stands first on our list. It consists of an inflammation, more or less extended, and more or less violent, of the membrane lining the nostrils, and hence reaching into and coating the inside of the windpipe and its branches. The symptoms denoting catarrh are familiar to every horse-keeper. A mucous or muco-purulent discharge comes from the nostrils, the matter being white or yellow, according as it partakes more or less of mucus; the membrane lining the nose is seen to be very red and inflamed, when the nostrils are opened; there may or may not be swellings under the throat, or just beneath the roots of the ears; and there commonly is present a cough; to which may be added, should the catarrh prove severe, the animal grows dull and feverish. It is now ascertained that "a cold" is caught by going from a cold to a *warm* situation; and not from exposure to *cold,* as those who gave it the name imagined; therefore, it is that young unbroke horses are the common subjects of it, and in particular at that period when they come to be removed from pasture for domestication.

Catarrh itself requires very simple treatment; it is only to be regarded as offensive inasmuch as it may prove the precursor or lay the foundation of some other disease of injurious tendency; such as roaring or inflammation of the lungs, or even glanders. On this account it ought seldom, in its mildest form, to be allowed to take its own course. In common cases, if we give the animal daily a ball composed of one dram of aloes, two drams of tartarized antimony, the same of ginger, with a sufficiency of syrup of buckthorn, and give him a bran or malt mash every night, with half an ounce of nitre mixed in it, and repeat this in the morning; about a week will perfectly reinstate him. In cases of much attendant fever, the animal should lose from two to four quarts of blood. The cough may be attacked either by a simple liniment rubbed under the throttle, composed of two parts of hartshorn, and one of sweet oil, or by blistering the throat with the *Tincture of Cantharides.* Some practitioners steam the nose with bran scalded in a nose-bag; for my own part, I have almost relinquished the practice, thinking that it oftener does harm than good.

Roaring is a disease also of the air-passages. Its common seat is either the windpipe itself or the mouth of that tube, which is called the *larynx.* Its nature consists in partial obstruction of some kind or other in some one of the air-passages, in consequence of which a peculiar sound or noise is created every time the air passes into or out of the lungs with more than ordinary force or celerity. The noise is more commonly elicited by the act of inspiration than expiration; occasionally by both. The nature and intensity of this unpleasant sound will depend upon the particular situation, extent, locality, and relative volume of the obstruction; and therefore it is that we are in some slight measure enabled to give an opinion about the disease when we examine the horse, according as we find him to be "a wheezer," "whistler," "high-blower," or "grunter;" all which jargon is in common use among horse-dealers, and has been from them adopted by professional men to denote certain kinds or stages of roaring, for which they have as yet no other terms.

The wheezer's noise has been well compared to the sound made by an asthmatic man: it has a deep-wheezing sound, and proceeds, we believe, from obstruction in some of the branches of the windpipe.

The whistler's note resembles "the northern blast" rushing through a crack in the window-shutter. It is occasioned by some diminution or contraction of the passage either in the windpipe itself or the larynx.

A high-blower is recognised by puffs or small blasts proceeding from the nostrils. In this case, the impediment is in the head.

The grunter emits murmurs or deep-buried sounds resembling the grunts of a hog. This noise, we are of opinion, proceeds from the ramifications of the windpipe.

The genuine roarer, or as he is sometimes designated, in contra-distinction to the other species, "the *confirmed* roarer," is the one whose boations, in inspiration, are too loud and too notorious to need characterization.

To detect this disorder, we must by some means or other force the animal to make a deep, sudden, or quick inspiration. The horse-dealer's mode of procedure (and it is the readiest and most summary one) is to make a feint at an unexpected moment to give the horse a blow upon the head, as though you were going to knock him down. Hard galloping, particularly up hill, and still more, hard driving in harness, are, however, the surest tests of roaring.

Whenever we are called on to treat roaring, we may assure our employer that the horse's life is in no danger; but we cannot, on any reasonable grounds, in the majority of cases, hold out prospects of success. Very many roarers are harness-horses, and become so disordered from the continual reining-in of the head by the bearing rein. These cases, if recent, are the most favourable we can encounter: the plan of proceeding with them consists in so confining the head that the very opposite tendency be given to it; viz. reining it as much outward or forward as possible, and at the same time elevating the nose: by thus posturing the animal for four or five hours every day, and working his mouth so as to produce the same effect at exercise, much benefit, and even a cure, may result. In other cases, repeated blisters along the course of the windpipe, or several setons passed transversely through the skin in front of it, aided by the absorbent effects of purgative and diuretic medicines, are the only measures likely to be productive of much amelioration.

Inflammation of the Lungs is the disorder which attacks and proves fatal to so many of our young horses on their first entrance into the stable. The various changes to which they are subjected, all, more or less, appear to conduce to it; but none in so great a degree probably as the change from a situation abounding with cold and pure air, to one whose atmosphere is confined, heated, and loaded with impurities. No animal seeks the open air to breathe more than the horse: he shows this disposition in health; he evinces a strong indication for it in disease; and, generally speaking, the more we gratify this natural propensity, the less subject shall we render him to disorders of all kinds, but particularly to the one now under consideration.

The characteristic symptom of this malady, that by which above all others it is known, is the short, quick, and painful respiration manifested to us by the heaving of the flanks and the working and puffing of the nostrils: the pulse also runs high; but very frequently is not so quick as the breathing. The animal's countenance betrays inward pain: he casts an impressive look round to his panting flank. His legs and ears are icy cold. His mouth is dry, even parched. He never is found lying, not even at night; but stands with his fore legs stretched out and apart, one from the other. Should the pulse and breathing run immoderately high, the mouth feel cold and clammy, and a cold sweat appear over the body, we may prepare ourselves for a fatal issue.

The treatment of this disease consists principally in the judicious use of the phleme: all other remedies are of secondary import. In general, the first blood-letting should be such as to have a perceptible effect on the pulse: it is impossible to say precisely what quantity it may be requisite to draw to do this; that will so much depend on the size, age, condition, and constitution of the patient. Having bled the animal, clothe him very warmly, flannel-bandage his legs, turn him loose into a box which has openings giving free access to the external air, and administer to him half a dram of the powdered root of white hellebore, the like quantity of aloes, two drams of emetic antimony, and half an ounce of aromatic confection. In six or eight hours, should the symptoms continue unabated, bleed him again; at all events give him another ball, which is to be repeated; providing he shows no disposition to nausea or purging, every six hours. As soon as an impression on the violence of the symptoms has been made by bleeding, blister both sides, and insert a rowel in the chest. During convalescence, it is proper to exhibit every other day a ball composed of nitre and soft soap, to prevent any accumulation of water within the chest, which is the most common fatal termination of the disease.

Broken Wind.

In contra-distinction to a roarer, a broken-winded horse is called a *piper*, in our vulgar horse cant. The subject of it is much sooner detected than the roarer; it being a disorder of much more general concern, and one that the animal manifests at all times, in a state of rest as well as action; in fact, there is no common dealer nor groom who is not well acquainted with its signs, and the injurious consequences resulting from it. Two denotations especially guide us in discovering it:—a peculiarly disordered breathing, and the particularity of the cough which accompanies it. Expiration becomes comparatively long, protracted, and difficult; inspiration altogether as short, sudden, and free: this is shown by the flanks very gradually and slowly contracting until they have drawn themselves up to their utmost, and then all on a sudden expanding and resuming their original fulness. The cough, which is only occasional, and most so under exertion, is so peculiar in its sound that, once heard, it can hardly ever be mistaken: it is *short* and *feeble*, scarcely audible at any distance; it appears as if it came from the very verge of the summit of the windpipe, or as if it had been *chopped off* in its passage.

The pathological nature of this disease appears to be still undetermined. The prevalent opinion seems to be, that it consists in a rupture of the air-cells of the lungs: this theory, however, is not free from objections; for it is said, that there exists rupture, occasionally, without broken wind, and again, broken wind without rupture: and if it were rupture, why should not some cases recover? which, it is well known, none ever do.

As to remedy, we possess none: it is an *irremediable* disease. From a habit which broken-winded horses have of often *breaking wind*, the old farriers conceived that the difficulty might be removed by making what is called an *artificial anus:* it is needless to add, that the expedient proved as effectless as it was absurd, cruel, and disgusting.

Diseases of the Organs of Nutrition.

The organs of nutrition comprise the mouth, the gullet, the stomach and intestines, and the liver; the milt and sweet-bread also rank among them, but *they* are very rarely found diseased.

Lampas is the term used by our common farriers to denote an unnatural prominence of the fleshy bars, crossing the roof of the mouth, just behind the upper incisive teeth. Many absurd notions are abroad respecting the origin and nature of this supposed malady, (for we can hardly regard it in the light of disease,) and still more are the means which have long been, and among the lower farriers even still continue to be, employed under the false cover of an asserted *remedy:* we allude to the cruel practice of cauterizing the swollen parts with a red hot iron. The veritable nature of this supposed evil is neither more nor less than an inflammatory turgidity of the gums as well as palate, the natural concomitant of the process of dentition; so that we discover lampas in the intervals between the 2d and 3d, 3d and 4th, and 4th and 5th years: and such being the true nature of the complaint, what can be more preposterously barbarous than the practice recommended in the Farriers' Dictionary, "to apply a hot iron to the parts, so as to burn the excrescence! away." With as much reason, and certainly (if there existed any at all) more necessity, might we introduce a heated iron into the mouth of a child suffering from the self-same malady—"cutting of the teeth;" when every surgeon knows that simple lancing of the gums is all that is required of him. And this is all that is required, too, of the veterinary surgeon. Lance the gums in cases when the animal manifests uneasiness or pain by refusing to eat his hay, and especially his corn, as usual; and give him scalded oats, bran or malt mashes, and green meat, &c. in fact any food easy of mastication.

Dropsy.—*Hydrothorax*, or water in the chest, is by no means an unfrequent occurrence in young horses: it commonly comes on gradually, as a sequel of inflammation of the lungs; and when once established, is, unfortunately, without the reach of any known therapeutic means. *Ascites*, or water in the belly, is a more rare disease. The author has met with two cases: one was a genuine case; the other turned out to be a sequel or consequence of inflammation of the membranes of the chest, followed by hydrothorax. Its presence is but obscurely indicated: the only sure tests are, a sense of fluctuation to the hand, and of guggling or undulation to the ear, combined with actual enlargement of the belly; rarely, however, has the practitioner been led to make these trials, from the fact of the disease being known to be quite out of the ordinary line of practice. In truth, we yet lack much information on the subject.

Stomach Staggers.—Gorged Stomach. Such is the phraseology we are compelled to adopt (for the want of a veterinary nomenclature) to express the disorder occasioned by preternatural distension of the stomach with food or air, or both combined. Neat cattle, it is known, are very liable, at certain seasons of the year, and in certain situations, to contract a disorder called *the hove;* the origin of which is, voracious grazing in some luxuriant pasture, (especially young spring clover,) which lying in the paunch too long, gas is extricated until the bag is distended even to bursting. This creates insufferable pain, and the animal runs wildly and furiously about, bellowing as if it were mad. The author has witnessed one very striking case of this description in the horse; the symptoms resembled those of violent grips; every thing had been practised which offered any hope of affording relief; but all in vain. The animal died in great torment, and a tympanitic stomach was found to have been the occasion of his violent complaints. Now and then it happens that the stomach becomes over distended with food, giving rise either to symptoms of common cholic, or to a very different set of symptoms, viz. such as indicate pressure upon the brain; which arises from the sympathy of the brain with the stomach. These cases commonly happen in large breweries, dockyards, and other places where horses are in the habit of being employed for many hours together without food. This injurious practice, however, has of late years been so much exposed and explained, that we seldom hear of any grievances of the kind. One of the most effectual preventives against the malady, is the plan now commonly adopted by brewers' servants, stage-wagoners, &c. of feeding with hay on the road, or carrying with them nose-bags.

Colic, or *gripes*, means, pathologically considered, a spasm or astriction of some part of the intestinal canal; though farriers use the phrase "gripes" to denote *all* the disorders of the guts, indiscriminately: it is, perhaps, properly speaking, only a term for the *pain* which the animal expresses. By veterinarians of the present day, it is synonymised with *spasm;* and spasm signifies a drawing together or involuntary contraction of muscular parts. We shall, therefore, apply the words *colic* or *gripes* to the disorder occasioned by spasms of the guts, of which the following are the symptoms. The horse is suddenly seized with extreme pain in his belly; he paws the ground, strikes his belly with his feet, lies down and rolls over, continually rolling upon his back, in which posture he will endeavour to maintain himself, and thereby appears to obtain some remission of his sufferings. All at once he rises again, shakes himself, and, by casting a doleful look back at his flank, seems to express where the seat of pain is, and to forewarn you that he is about to undergo another paroxysm, which is commonly more violent than the preceding one. At the onset, the *remissions* or intervals of ease are commonly well defined; but, as the disorder advances, the paroxysms prove more violent and longer in duration; the remissions become shorter, or may be, in the advanced stages, altogether wanting. The pulse, in the interval of ease, betrays little or no alteration; it is only during the paroxysm that it becomes contracted, even to a thread, and quickened. The belly feels tense, the animal flinches when it is pressed hard or struck. Costiveness is an attendant, and no urine, commonly, is voided. Gripes may be the consequence of an ingurgitation of cold or spring water, and particularly at a time when the animal is heated; it is also the effect occasionally of green food; at other times its origin seems to be referable to some indigestible or foreign matters within the alimentary canal. Fortunately for the suffering animal, this is a disease which commonly admits of ready and speedy removal; and it is this fact which enables us to explain the extraordinary anti-spasmodic virtues which have been ascribed to, seemingly, very different remedies. There hardly lives a farrier or groom who has not some *secret cure* for gripes. In Kent, we are informed, they swear to the infallibility of gin and pepper. At our veterinary college, spirits of turpentine is pronounced to be the orthodox remedy. Others declare that every efficacy resides in pimento and peppermint waters mixed. The writer himself believes that these and every other known article of our materia medica, are inferior in anti-spasmodic power to opium; he has been in the habit of giving from two to four ounces of laudanum, mixed with an equal quantity of spirits of turpentine or peppermint or pimento water, (it imports little which,) and the mixture diluted with double its quantity, viz. a pint of warm water, or with (perhaps what is better) warm ale. As soon as this drink has been administered, the animal's belly should be well rubbed: after which he should be thoroughly raked, and a copious clyster of soap and warm water injected. This done, he may with advantage be taken out of the stable, and led about for half an hour. Should these means fail to relieve him, repeat the drink, the clyster, the friction, and the exercise; and commonly by the next half hour all pain will have subsided. Bleeding is only *necessary* in cases which resist these milder measures; but when it is practised, a copious quantity (6 or 8 quarts) of blood should be withdrawn. All this while, we are to keep a steady watch on the pulse, and be prepared for inflammatory action, which not unfrequently succeeds to this spasmodic disturbance: its approach may be suspected by the unyielding obstinacy of the attacks, their more frequent occurrence and longer continuance, and its *supervention* confirmed by *the symptoms answering to* the following description.

INFLAMMATION OF THE INTESTINES OR BOWELS.—Many of the symptoms indicative of this affection equally denote the presence of colic; in fact, they may be called signs of almost any acute pains in the belly, rather than be said to belong to any one particular disorder; such are the pawing, the continual lying down and rising, the looking back at the flank, &c. But inflammation of the bowels is frequently ushered in, and always accompanied by fever; whereas, of colic, fever is neither a precursor nor a natural concomitant: there is no fluctuation of pulse in inflammation; it is from the beginning, and continues, exceeding quick and firm in its beat. The surest diagnostic, however, between these maladies, is, that the one is made up of fits of pain and intermissions of ease; whereas, the other consists of one continued attack. *Cold* has been called much into question as an agent actively concerned in the production of this disorder: but I verily believe myself upon no better than analogical grounds. People are far too apt to run away with the idea, that what is injurious to themselves must prove so to their horses; than which nothing turns out to be more fallacious. I believe the ordinary excitants of the disease to be—excessive and long-continued exertion, high and irregular feeding, obstructions and stimulants of various kinds within the bowels. Inflammation of the lungs, although a rapid disease, is not one which runs its course ordinarily with near the same celerity that the one under our consideration does: it frequently happens that a few hours place the patient out of the reach of remedy; it therefore becomes our special duty in these cases to determine at once on efficacious measures, and to put our determinations with all possible promptitude into execution. Two gallons of blood, nay more, (providing the animal's strength will bear it,) are to be drawn immediately in a full copious stream from the jugular. One ounce and a half of Barbadoes aloes is to be dissolved in a pint of boiling water, the solution strained and afterwards mixed with an equal quantity of water gruel: or, instead of it, a pint and a half of castor oil: either of these, as a drink, is to be given immediately after the bleeding. The next thing required to be done, is to remove all the dung within the reach of the arm from the posteriors, and to follow this raking operation up with the injection of glysters, consisting of two or three gallons of salt and soap water, medicated with a solution of aloes. Fomentations to the belly, as hot as they can be applied, should be had recourse to; which we are to succeed by the application of the strongest blistering ointment to the entire abdominal surface: some prefer the mustard poultice, others use equal parts of an infusion of cantharides and oil of turpentine. It has been a practice to fire the belly with a broad flat-iron heated; and when the symptoms are dangerously urgent, and other means of exciting counter-irritation have failed, there appears no objection to it. A repetition of these remedies must be practised at short intervals, providing the symptoms indicate the same unabated violent pains; the bleeding in particular must be carried as far as the animal's strength will allow. What we have to dread, is mortification of the guts—a state that must be followed by death. In regard to regimen, the horse will eat nothing during the pain; what he eats at other times should be exclusively *soft* meat; he ought to be warmly clothed—the skin cannot be kept too warm: his legs should be bandaged with flannel; and a box in which he can turn loose, is the best situation for him.

Flux, *looseness*, or *scouring*, now and then troubles horses; it is much more common, however, among cattle; and especially sheep. They do say, that horses grazing long in marshy pastures in cold weather, will, like sheep, contract the disorder: the writer, however, has never happened to be so situated as to witness its propagation in this manner. Thirty years ago it was a very common practice, indeed the ordinary one among grooms and gentlemen, (their own horse-doctors,) to exhibit an ounce and a half, or two ounces of aloes, at once, by way of " a dose of physic;" and, in this manner, many and many a valuable horse has been sacrificed, in consequence of super-purgation. But even now-a-days, although these murderous doses have been abridged, aloes or doses of physic continue to be quite as indiscriminately and injudiciously prescribed by these instinctively learned gentry. There is another cause of disordered bowels, and one we meet with more frequently at the present day; and that is, *over-exertion*. After a " *hard* day's riding," a horse will, occasionally, express much uneasiness and irritation in his bowels, by continually voiding small portions of excrement, enveloped in slimy, viscous, mucous matter. This is what the farriers call " molten grease:" they, in their egregious ignorance, really believing it to be *fat* or grease *molten down*.

In pretending to administer to the relief of an animal affected with the flux, even some veterinary men, but farriers especially, are apt to proceed on a principle perfectly incongruous with the nature of the complaint; viz. to *put a stop* to the discharges; whereas, in point of fact, they ought rather to be encouraged than suppressed: at all events, *early* in the disorder. The flux is to be considered as an effort of the parts themselves to cast off something which is obnoxious to them; and it is our duty to render them our assistance in effecting it. It is only when we discover that it is producing irritation in the system, or by its continuance consuming the strength of the animal, that we are warranted in using means for its suppression. Soft meat, gruel, linseed drink, hay tea, &c. are all very suitable for its encouragement, and at the same time for supporting the strength. Scrupulously abstain from every description of green food. Should we be able to trace the origin of the flux to green pasture, nothing will prove so good a counteraction as an alkali, and one of the best is common chalk; which also possesses an astringent quality: as much of the powder may be given, twice or thrice, or oftener, in the course of the day, as can be made up with syrup of poppies into a full-sized ball. We know that to calves, when they scour, chalk is given with great advantage, made into balls with gin. A better medicine, however, particularly when the case has been of long duration, is chalk and mercury—the *hydrargyrus cum creta* of the London Pharmacopeia: half an ounce, or even an ounce, may be administered twice or thrice a-day. Last of all, and only when our object is to put a total stop to the discharges, we are to have recourse to opium; to give a dram of solid opium in combination with half an ounce of chalk, made into a ball with syrup of ginger: one ball will commonly prove sufficient for this purpose: should it not, or should the flux relapse again, after having been once subdued, a second and a third must be administered. It is rarely required to give more than one ball a-day.

Stones (*calculi*) and other concretions of various kinds, are every now and then met with in the intestinal canal. They are more commonly found within the *large* guts. These substances differ in composition, magnitude, and shape. Some are purely calcareous; others are resolvable into what appears to be nothing more than collections of hardened fæces. Their form and size seem to be regulated principally by the situation wherein they are lodged; at times, however, it is clearly determined by a central nucleus: a horse-nail, *e. g.* has in several instances, from having been swallowed accidentally, become the nucleus of a calculus, which in form has precisely resembled it. There is a calculus into whose composition *hair* enters largely; but this is met with in neat cattle more especially, owing to the habit cows have of licking their own hides, and swallowing the hair. The majority of intestinal calculi are white.

We shall have no difficulty in accounting for the formation of calculi within the guts, when we come to know that the horse, under certain circumstances, is an animal that will absolutely lick up and eat the very earth he treads upon: craving horses in confined situations, with an insufficient supply of provision, will, for the want of more food, pick up dirt, gnaw rails, and be apt to destroy or consume almost any thing within their reach; and in this way they lay the foundation in their insides for concretion. Independently of this, however, we are to bear in mind that most horses do necessarily consume a quantity of dirt with their food: millers' horses in particular are subject to calculus, in consequence of the meal they are fed upon containing particles of the grindstones. We know of no symptoms unerringly denoting the presence of intestinal calculus; and even were we certain about its existence, have we any thing feasible to propose by way of remedy.

Worms. Four kinds of worms have been discovered within the bowels of horses; the *bot;* the

the *long, round, white worm;* the *thread-worm;* and the *tape-worm.* The Bot is an inhabitant *natural* to the stomach: now and then we find some in the adjoining intestine; but we never detect any *resident* either within or near to the *large* guts. Properly speaking, the bot is not a *worm* at all: it is simply the *larva* or caterpillar of the gad-fly, bearing the same relation to the fly itself as the silkworm does to its moth. This renders its natural history very curious. Every groom knows that it is only at a certain season of the year that horses void bots; on the other hand, every veterinarian is aware that, although none are expelled, bots exist in the stomach all the year round. The explanation of these notorious facts is this. At the latter end of the summer, the time when horses are teased most by flies, the gad-fly makes his appearance, of all the tribe the most formidable; the female of which insect it is that especially haunts the horse in order that she may deposit her eggs somewhere upon his coat. By the act of biting or licking themselves, which horses are prompted to from the bite of the fly, it appears that the eggs are transported upon the tongue, and thence pass, probably with the food, into the stomach; where, from heat and moisture, they become hatched, and give origin to a small active worm which grows by the ensuing summer to a bot. About June, having completed its growth, it becomes expelled from the body with the dung, in which it lies enveloped upon the ground, whilst it again changes its state by becoming a *chrysalis* or grub. It has yet to undergo its last transformation in the series, viz. that into a fly, which takes place after it has lain a few weeks in the dung. Of the newly created flies, the males seek their mates; the female, as soon as they have become impregnated, range in search of a horse upon which she chooses to deposit her eggs.

For what wise end or purpose the stomach of a horse was made the nidus for an animal of such apparent insignificance as the bot, we shall not pretend to divine: we have no proofs that they do any harm there; neither can we take upon ourselves to say that they are productive of good. The mucus of the stomach appears to furnish them with aliment; but the little they must consume cannot render it of much importance, one would think, whether it be that or the alimentary matters themselves. The complaints of grooms and others, therefore, about their destructive effects appear to be totally devoid of foundation. It is this impression of their pernicious agency that urges people to feel desirous to have them got rid of: the truth of the matter is, however, that in consequence of the bot having two hooks by which it clings fast to the lining of the stomach, we have no means of effecting this, even though it were really necessary; we can, certain enough by administering a dose of purgative medicine at the season when we see them voided, cause them to be expelled quicker and in greater numbers; but, then, if we would but have patience, they would all come away spontaneously. While they maintain their hold, no medicine that we know of possesses the power of causing their expulsion; nor have we any drug that will destroy them without proving equally destructive to the parts to which they cling.

The Long Round White Worm (*lumbricus teres,* as it is technically called,) in form resembles the common earth-worm. They inhabit the small intestines; at least, are but rarely found in the large; and never, we believe, in the stomach. Farriers and grooms entertain strange notions about these worms; whenever they discover one, they never fail to ascribe the most pernicious effects to it: there appears, however, but little reason to believe that their complaints are well founded; indeed, from all that we have been able to collect, we should say that their destructive tendency has been greatly over-rated. The only unerring test of their existence is, that one or more have been discovered in the excrement; in which case a dram of tartar emetic may be given in bran-mash every night for a week; and after that, a brisk purge.

The Thread-worm (*ascaris*) much resembles the worm of the same name found in the human bowels. In the horse, they are found occasionally in prodigious numbers in the large guts, and above all, within the blind pouch of the cœcum. We believe this to be the most destructive species of worm; and one which it is advisable to get rid of. We have no sure evidence of their existence but their presence in the dung. Castor oil has been recommended for their expulsion: we do not reckon it to be so efficacious as aloetic purges, which, in these cases, should be preceded by five or six turpentine drinks: each drink being composed of six ounces of spirits of turpentine, and a pint and a half of warm water, to be given twice a-day.

The Tape-worm is exceeding rare in horses: our experience, which has been neither short nor limited, does not furnish more than three cases of it. Indeed, as a deceased veterinary author has truly observed, "but from the circumstance of the *possibility* of it being met with, the tape-worm is so very rarely seen that it would scarcely deserve to be noticed as an enemy to the horse."

Jaundice is rather an unfrequent disorder in the horse. It is, however, occasionally seen, and therefore calls on us for some account. The yellow tinge the skin acquires, the mouth and eyes in particular, at once betrays its existence. The bowels become costive, the excrement voided is hard, buttony, and dark coloured, and sometimes besmeared with a yellow stringy matter, which appears to be bile imperfectly mingled with mucus. The animal is evidently much depressed. He hangs his head, his eye-lids droop; he mopes about and appears very stupid, and is heedless of what is going on; indeed, often he staggers in his walk, showing vertigo even to be present. The pulse is increased in frequency, but the respiration continues undisordered.

In the treatment of jaundice, our chief reliance is to be placed in inducing a state of copious purgation. No time should be lost in administering from ten to twelve drams of aloes, in combination with syrup of ginger; and should there be much stupor or any vertigo present, I would at the same time draw blood, but not to any very large amount —say four or five quarts. As soon as the bowels are freely opened, apply a large blister to the off side, and keep it discharging by dressing it morning and evening with fresh blistering ointment. It may be necessary to recur to venesection. The purgation must be kept active.

Now and then jaundice proves fatal. Probably some time has elapsed before medical aid is called in; the bowels resist the first dose of medicine; the pulse continues to rise notwithstanding the use of the lancet; the skin and extremities become cold; the animal grows senseless and vertiginous, and in that state he drops down and expires.

Diseases of the Urinary Organs.

The practice grooms and farriers have of giving and repeating what they denominate "urine balls," whenever the animal shows any unusual efforts or difficulties in staling, may be said to lay the foundation for most of these disorders; at least for such of them as are seated in the kidneys.

INFLAMMATION OF THE KIDNEYS, unless perchance it be induced by some violent sprain or other mechanical injury about the loins, may mostly be traced back to the injudicious use of diuretic medicine, or else to feeding on mow-burnt hay or *foxy* oats, which have the same effect: there are instances likewise, we believe, where it originates in giving horses strongly impregnated waters to drink. The symptoms denoting this disease, are, the horse stands wide and stiffly with his hind legs; and he straddles in his walk. Probably, he shrinks from pressure upon the loins. He either (although he makes frequent efforts) can make no water at all, or he voids but very little every now and then, and that little is, perhaps, bloody, or turbid and thick, as if it were mixed with matter.. The pain the animal is in, causes him to refuse all food, and induces fever in the system, quickening the pulse, &c. In order that we may not labour under any mistake in regard to the nature of the malady, before we proceed to treatment, the bladder ought to be examined: its emptiness confirms our diagnosis; on the other hand, its fulness shows that the disorder is *not*—or at least, *not altogether*, in the kidneys.

In the first instance we must bleed pretty freely, taking away from six to eight quarts of blood. That done, we should administer a large dose of purgative medicine; viz. eight or nine drams of aloes mixed with syrup of ginger: first, the horse having been raked, and a clyster administered. Finally, the loins must be fomented with water as hot as it is possible to use, and the fomentation succeeded by a mustard embrocation. Every inducement should be practised to make the animal imbibe large quantities of water; or, what is better, linseed tea. All kinds of diuretic medicine must be scrupulously abstained from.

DISEASES OF THE BLADDER are comparatively rare. When the kidneys are the seat of disorder, no urine, or hardly any, is furnished; on the contrary, when the bladder is disordered, as much urine as usual is supplied, but none or but very little is voided. The simple test, therefore, we have to employ, is, the manual examination of the bladder. Disease of the bladder being a very painful malady, the animal will paw, lie down, and rise again, and otherwise express much uneasiness; but he will not manifest that rigidity and tenderness about the loins which is indicative of diseased kidneys.

In addition to the remedies recommended for inflammation of the kidneys, (which are equally applicable to the case before us,) providing after the bleeding, purging, and fomentations, that no urine be voided, we are to pass a catheter into the bladder: which is done by first thrusting a long whalebone probe up the urethra as high as its curvature; then, cutting down upon it with a scalpel or penknife; and lastly, introducing a female catheter and pushing it onward into the bladder.*

Stone in the Bladder has occurred in the course of our practice; but it is extremely rare indeed. Should such a rarity be suspected to be present, the only sure criterion we have, is manual examination: which may be conducted with great ease, as well as effect, by casting the horse upon his back, and passing the hand up the rectum. Should a stone be found, it will require the operation of extraction.

Diseases of the Brain and Nerves.

STAGGERS is the farrier's appellation for *the disorders of the brain;* and observation (which, so far as it goes, is accurate) has led them to make a division of the disease into two stages, distinguished by the phrases *sleepy* and *mad staggers.*

The lethargic state, denoted *sleepy staggers,* may, as we have before intimated, indicate either an overcharged stomach, or a plethoric state of the vessels of the brain; in which latter case it is, in general, only the prelude to a very different condition, viz. to mad staggers. A horse thus affected will stand with his head thrust against some hard body—the rack, wall, or wainscotting of the stable—with his eyes closed, and doze until he falls asleep, and drops down, or perhaps backwards in the stable; which suddenly awaking him, startles and alarms him prodigiously. The eye is very worthy of observation: it has a remarkably full, staring aspect, and at the same time betokens stupidity and torpor. The pulse is slow; not more than 30; unless when any thing rouses the animal, and then for a few seconds it beats with exceeding quickness. In some instances, the breathing is stertorous. These (lethargic) symptoms may continue for several days, and at length end fatally; or they may be succeeded by the mad fit, which has a still more dangerous tendency. The first warning of the approach of madness may be gathered from the rising of the pulse, and the quickening of the respiration. The eyes, before heavy and sleepy, now become animated. He stares wildly around him. Fits of delirium seize him. He furiously dashes himself about, throws himself down, and lies in a state of temporary insensibility; suddenly he rises, again to become seized with the phrensy, or to relapse into his former state of stupor and somnolency, from which he is only roused by another fit of madness.

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* An elastic catheter has, lately, been pushed into the bladder of the horse, without any incision whatever—after the manner of passing the bougie into a man's bladder.

If any one disease more than another calls for the free use of the phleme, it is the one under consideration: we must bleed until the animal actually reels under the loss of blood—take away from two to three gallons. And not only bleeding, but purging likewise is of paramount importance here: it is a common saying, "purge a horse with staggers and you cure him;" and there is great reason in it. The best method of procedure is to give an ounce of aloes every 12 hours, until the effect is produced; and in the intervals, rake and clyster. The head, across the forehead and upon and behind the poll, should be closely shorn, and afterwards blistered. And the legs also, which are in general icy cold in this disorder, must be stimulated either with a blistering application, or with mustard poultices.

Locked Jaw (*Tetanus*) is one of the most appalling evils in our catalogue. Though a disease of the nervous system, its effects are more particularly visible in the muscles; and most of all in the *voluntary* muscles; which are all seized with a *spasm* or rigidity, so that the animal can move no part but with pain and difficulty, while some parts are altogether immovable. The approach of the disease is generally slow. The animal commonly first shows some rigidity about the neck in turning his head to one side, which, in the course of a day or two, so much increases that he cannot turn his head at all without carrying his body round too. The refusal of his food leads to an examination of the jaws; and they also are found rigid, or greatly limited in their dilatation, so that the mouth can be opened only to a certain extent, or even hardly at all. The eye becomes the next object of attention: every time any thing frightens or annoys him, the animal throws up his head, and at the same instant the haw is seen passing over the eye, which forms a very striking character of the malady. The limbs, now, should they not have already become attacked, likewise grow stiff, either rendering progression awkward and unnatural, or else almost impeding it altogether: indeed, in violent cases, the fore and hind legs are stretched out underneath the body like the four legs of a stool or form; the back and loins become shrugged up from rigidity; the tail is elevated and tremulous; the ears erect; the nostrils expanded; and the countenance displays a degree of eagerness and anxiety which, once seen, it is hardly possible to mistake; in short, the poor suffering animal exhibits altogether a truly impressive and pitiable aspect, too characteristic of the hopeless condition he is in, to admit of any possibility of doubt or dispute concerning the nature of his relentless disease.

Locked jaw may arise of its own accord, or at least without any apparent cause; or it may be, and most commonly is, the consequence of some local injury. We have many examples of its having been induced by nicking, and docking, and punctured wounds, particularly into joints, or the feet; and the curious circumstance is, that the disease generally makes its appearance after the local wound is healed up, and we conclude all is well.

We certainly continue much in the dark concerning what mode of treatment ought to be adopted for this disease; though it would appear, as far as our recent experience has gone, that of all the *declared "remedies"* none deserve to stand so high as *opium*. It behoves him, however, who sets about to treat a locked jaw, to remember, 1st, that it is a malady that has but very rarely yielded to remedy, and 2dly, that opium, like every thing else, has too often failed to give the slightest apparent relief; at the same time, opium seems to have done more than any other medicine, and consequently especially merits our notice. In the first instance, it is advisable to draw blood, especially if the horse should happen to be in full condition; and also to administer, as early as possible, two ounces of purging mass, whose operation may be promoted by injections. As soon as the bowels have become freely opened, or even before, should the case prove anywise urgent, begin with the opium; if possible, administer half an ounce *in ball* twice a-day; but, should the jaws not admit of this being accomplished, (even by fixing the ball at the extremity of a stick,) an equivalent quantity of *laudanum* should be exhibited. Blisters may be applied, or setons inserted, along the course of the spine, and upon the head; but our chief reliance is to be placed in the exhibition of opium.

THIRD CLASS.—LOCAL DISEASES.

These, for the most part, are diseases connected with *foot-lameness*; those that are not, we shall consider first.

Poll-Evil is the name given to a tumor or abscess which forms behind the *poll*, in the cavity between the occiput and first cervical vertebræ. It owes its origin to blows or some other injury; probably to the constant pressure of a stiff, hard, or tight head collar. So long as the skin remains unbroken, the swelling, if soft and yielding, should be frequently fomented, and warm vinegar may be used in place of water; but if it has become hard, it will be better to rub it daily with sal-ammoniac dissolved in vinegar, or else to blister it. Should the inflammation run high, the horse may at the same time be purged, and also, if in high condition, even bled with advantage. In case such measures to disperse the tumour fail—should it, in spite of all we can do, continue to enlarge and grow soft—we had better give vent to the matter at once, than wait for its spontaneous issue; for, when once formed, the matter is apt to burrow between the bones and ligaments, and do a great deal of mischief. Therefore, give it a free outlet: and afterwards search the cavity with a probe in order to inform yourself of the number and direction of any *sinuses* or pipes that may lead from the main chasm;

which, as far as is practicable, it is generally the best practice to lay open into the great cavity. A great variety of dressings have been recommended to our notice, and the truth is, that, taking them altogether, they may prove serviceable or unserviceable, according to the nature of the case and the discretionary judgment of the employer of them. Caustic dressings are mostly required in the first instance, and should be persevered in until the parts assume a healthful appearance, and the matter discharged is considered what is called "laudable" pus. When any dead bone or gristly or sinewy materials remain to come away, the nitric acid lotion will be found most proper. As a caustic, we have used powdered arsenic with great advantage. A mixture of blue vitriol and sulphuric acid, made into a paste, is also occasionally useful. Whenever healthy action is established, oily or greasy applications are to be preferred, and the simpler they are the better: alum or citrine ointment, or a turpentine unguent, or even simple ointment.

Fistula. Properly speaking, this is the surgical term for a long, narrow, winding sinus or pipe, in *any* situation or part of the body; but it has, somehow or other, got to mean, in common colloquy, a disease seated in the *withers*, of precisely the same nature as poll-evil;—consisting of a tumour, or (should that have broken) of an open sore upon, or rather at the side of the withers. In fact, poll-evil and fistula are so identical in their nature, only that one is caused by the head-collar, while the other originates in the pressure of the saddle, or else the harness-collar, that it will be unnecessary for us to say more on the subject.

We shall, therefore, now proceed to an account of the several local diseases connected with lameness.

Shoulder Lameness.—It by no means unfrequently happens that horses, either in consequence of a misstep, or some twist or outstretch in action, sprain their shoulders, mostly one; occasionally, but rarely, both: the latter occurrence we have witnessed in horses practised much in riding schools. The peculiar gait of the animal—the dragging of the toe, and the circuitous fling he gives the affected limb in action (confirmed by the absense of any other visible cause for the lameness) are here our only guides; nothing is to be seen or felt about the shoulder; the injury is too deeply seated to show itself by any external signs. The remedies proper, are, to draw blood from the plate vein; to foment the point of the shoulder; and afterwards apply a mixture—of *sal ammoniac* one oz.; vinegar and spirits of wine, of each, six ounces; water, twelve ounces. Should this, combined with a state of rest during the time, fail to relieve within the space of a week or ten days, the whole surface around the point of the shoulder must be blistered with an infusion of cantharides (without removing the hair).

Clap in the Back Sinews, means *a strain of the flexor tendons of the leg*. It may, and sometimes does in hunters and racers, take place behind; but its common seat is one of the *fore* legs. The true nature of an ordinary strain is nothing more than a violent stretch, attended probably with laceration of the cellular tissue connecting the tendons together, and to the other parts in their immediate vicinity. In violent sprains of the tendons themselves, it is possible that some of their own fibres may be torn or overstretched; but that the tendons are ever *torn asunder*, as the phrase "broken down," (which is commonly applied to a violent accident of this description) would seem to denote, is not correct: they are much too strong in texture to admit of it in such a case as the present. The accident is at once discovered to us by the swelling, heat, and tenderness of the leg, and more particularly of the posterior part of it; and also by the excessive lameness which attends it while recent.

In setting about the treatment of this affection, our first object should be, to subdue the existing inflammation: which is best accomplished by drawing blood from the plate vein, by continual fomentation, by a cold lotion and bandage around the leg, and by giving a dose of physic, and keeping the animal on mash diet. What is of much consequence, also, is having a shoe put on with raised or high heels, in lieu of the one which the horse has on at the time. When the inflammation is on the decline, the cold bath should be substituted for the fomentations; and the bandage applied more tightly round the leg. Should any swelling or thickening remain after the subsidence of the inflammation, *sal ammoniac*, spirits of wine, and vinegar, mixed, should be rubbed on the leg, still using the bandage as before. After continuing this for a few weeks, should there still remain any thickening it may be desirable to get rid of, the leg may be blistered, and subsequently fired.

Spavin. This affection consists of a small bony tumour growing out from the inner and lower part of the joint of the hock. It is a malady of every-day occurrence; and yet one that is frequently overlooked. For in the situation in which it occurs, there is *naturally* a projection; and oftentimes great discrimination is required, combined with an experienced eye and hand, to decide whether there really is preternatural fulness of the part or not. A spavin will, in some instances, occasion exceeding tenderness and lameness; in others it will not in the least affect the natural action of the animal: all which depends on its situation, whether it interferes or not with the motion of the joint, as also on the presence of disease or not in the interior of the joint.

While recent, cases of spavin admit sometimes of cure, at other times only of relief; but when once the disease has, from time, become established, we shall rarely succeed in the treatment of it; or, at least, to confer any permanent benefit. The remedies for a recent spavin are—bleeding from the thigh vein, and blistering the tumour, followed by a state of rest. Cases of long duration may be fired and blistered, or they may be setoned; but either is seldom performed with any permanent benefit.

Blood-spavin is a soft fluctuating tumour, absurdly so called, simply because it occupies nearly the same situation as the true or bone spavin. In fact, it is not a disease at all: it is simply a dilatation of the vein as it crosses the inner and inferior part of the hock, occasioned by the formation of a windgall underneath it, just above the dilated part. It is not attended with the slightest inconvenience to the animal, and therefore it would be folly to interfere with it.

Windgalls are dropsical enlargements of little membranous bags called *bursæ mucosæ.* They are incorrectly named; for in place of *air*, they contain a fluid very similar to water. They have various situations in the body: we most commonly find them in the hock and fetlock joints. They owe their origin to hard work: the repeated stretching and straining of the joints in violent exercises, such as hunting and racing, occasions these bags to be filled with fluid; under the pressure of which they gradually yield until they acquire, in some instances, considerable magnitude. They seem to be productive of no pain; and consequently are not attended with lameness.

From the circumstance of their being, especially when very large, regarded as eyesores, we are often called on to disperse them. And with this view, we may use in succession, bandages, discutient lotions, and, finally, blisters: or the joint may, if required, be fired. The practices of puncturing the swellings, or introducing any sort of caustic into them, are to be reprobated as highly dangerous, not only to the limb, but even to the life of the animal, in consequence of the pain and irritation which they are certain to create; and more particularly in regard to windgalls of large size or long duration; for they very frequently communicate with the cavity of the joint with which they are connected.

Bog-spavins and *Thorough-pins* are nothing more than windgalls upon or *through* the hock; precisely of the same nature as, only differing in situation from, windgall upon the fetlock.

Curb is a solid, firm, ill-defined tumour, situated upon the posterior part of the hock, about three inches below, but in a direct line with its point. It is most perceptible on a lateral view, being then recognised by a convexity or prominent deviation from the natural straightness of the posterior outline of the limb. Recent curbs, especially such as have made their appearance suddenly, are hot and tender to the feel, and are attended with considerable lameness; but it is quite otherwise with old and callous curbs; all inflammation having left them, they produce no lameness or pain on pressure whatever; and the horse continues his work with as much apparent facility as if they did not exist. Curbs are induced by extraordinary or violent action, and are more likely to result in young horses, in which the hocks have not arrived at their perfect formation and strength. Horses that have *sickle-hocks* (by which is meant *bowed hind* legs) are more disposed to throw out curbs; whence such hocks have also got the epithet of *curby.*

In undertaking the cure of a curb, our first consideration ought to be to abstract the inflammation from it; the second, to disperse the tumefaction. Drawing blood from the thigh-vein; hot fomentations, and discutient lotions, aided by a little opening medicine, will effect the former; but the latter can only be accomplished by a repetition of blisters, or by a charge; and in either case the animal should be turned out for six or eight weeks. Should lameness relapse from an old curb (which every now and then it will do), after the inflammation is subdued, the part should be fired.

Splint is a hard knot or small osseous tumour upon the side of the cannon; commonly the *inner* side. In technical language, and in allusion to its veritable nature, a splint is an ossification of the gristly substance uniting the small to the large metacarpal bone; for we seldom see a splint in the *hind* leg. And yet so common are splints, that we will venture to affirm, that ninety horses out of a hundred that have completed their sixth year, have them in one or other leg. In fact, after a certain period of life, the change which we regard here in the light of disease, appears to be natural, inasmuch as it seems necessary to give additional strength to the parts. This fact (of splints being almost invariably present), connected with the equally notorious one of their rarely or never occasioning lameness, or even inconvenience, have rendered them to be regarded with comparative insignificance: they would seem to be no longer looked upon as constituting unsoundness, unless accompanied with lameness; and very justly and reasonably are so considered; for, if it were otherwise, as we have just observed, we should hardly know where to find a sound horse.

Should it be required to treat a splint, either on account of its magnitude, or any inflammatory action going on in it, nothing proves so effectual as a repetition of blisters; they, however, should consist of the strongest ointment of cantharides, and the hair should be closely shorn off the part prior to their application.

Grease. A nasty name for a nasty disorder, consisting in an undue issue of a peculiar, *greasy*, offensive matter, from the hollow part we denominate the *heel.* There is, in a state of health, a continual oozing from this part, of a secretion of a ceruminous nature, which serves to lubricate it, and facilitate flexion and extension (the same as is the case in the arm-pit of a man), and it is in consequence either of the filthy condition of the part, or an attack of inflammation in it, that this secretion becomes altered in quality, or quantity, or both: in which consists *grease.* The most common cause, of all others, of this disorder, is the practice of washing or wetting the heels, and allowing them to get dry spontaneously: this, in cold weather in particular, by the evaporation it creates, leaves the heels in a state of coldness; in which condition they are, like all other, and even more than most other parts, susceptible of inflammation, which is almost certain to come on with the return of heat or warmth to them. The inflammation gives rise to the augmented issue; its continuance alters its nature; the matter collects and incrusts about the heels, rapidly grows putrid, and thus becomes the source of a stinking, loathsome effluvia. The disease may be confined to the hollow of the heel, or it may extend up the back of the leg, even as high as the hock. In the first stages, it consists simply in altered action of the secreting parts—in an issue unnatural in quantity and quality; but gradually, in the advanced stages, the skin itself, from which the discharge comes, undergoes a change; its surface becomes pimply and exceeding tender to the touch, and ultimately little irregular pustulous eminences arise from it, to which, on account of their form, farriers have given the appellation of *grapes;* in such a manner that, in the fully formed state of these excrescences, the leg (to use rather a happy comparison of Sainbel's) altogether resembles "the outward coat of a pine-apple." In the first instance, but little soreness is manifested; but, as the disease spreads, and particularly whenever the leg becomes much swollen, the pain on motion appears to be intense; for the horse will catch up the diseased limb, and hobble along upon the three others, rather than bear the smallest weight upon it.

The treatment will be simple, or more or less complicated, according to the duration, stage, and virulence of the disorder. A case consisting simply in augmented issue will require only some mild astringent application, such as *equal parts of the powder of alum* and *bole Armenian*, or *of those of charcoal and calamine;* or, should an ointment be preferred (and it is what we are in the practice of using), *two drams of finely powdered alum* are to be rubbed into *an ounce of hog's lard;* or, what the druggists sell as *mild citrine ointment.* Should the legs fill, a diuretic or purging ball should be given at the time, and the animal must be walked out twice a-day. Whenever the heels, however, are hot, swollen, and tender, instead of this, emollient poultices must be employed, and continued until such time as the inflammation is mitigated; after which astringents may be used. When there is much fœtid discharge, a charcoal poultice will be found to be the best corrective. In neglected, rancid cases, as soon as we have diminished the inflammation in the limb by local bleeding, purging, and poulticing, we must apply this liniment to the heel, after the manner of a poultice, viz. two drams of powdered blue vitriol, half an ounce of alum in powder, and one ounce of Armenian bole, mixed together, and stirred into three ounces of common oil. It should be allowed to remain applied three days; after which the horse should be exercised well, to take the swelling away, and then fresh dressing is to be applied. In this way may a certain cure be effected in all cases excepting those having grapes: and they must be cut off with a sharp knife, and afterwards cauterized; after which, the same liniment, with twice the quantity of the vitriol, should be applied all over the diseased surface.

Ring-bone. An osseous tumour, situated upon the pastern bone; so called, because very commonly it forms a sort of *ring* around the circumferent surface of that bone. It is very similar in its nature to splint or spavin; indeed it originates, like them, in the overstraining of soft parts, which in consequence take on diseased action, and become converted into bone. Over-weighting young horses, or putting them out beyond their powers, are the common sources of spavins, splints, curbs, and ring-bones.

Ring-bones may be accompanied with lameness or not, depending on the presence of inflammation, and on the degree of it; also on their volume and situation, so far as they may or may not interfere with the motions of the pastern joint. Repeated bleedings from the toe, blisters; or first firing, and then blistering, are the only remedies worthy of mention for them.

The diseases productive of lameness which remain to be described, are all seated within or about the hoof, and one of the most important is *fever in the feet*, by which is meant *inflammation* of the sensitive parts generally contained within the horny cavity. The symptoms of this malady are so remarkable, that, having witnessed one case of it, it is hardly possible ever afterwards to mistake it. The animal cannot tolerate long the pain of bearing his weight upon the affected feet. Should the disease be confined to the fore feet, he will bring the hind ones as far forwards as possible underneath his belly, in order that *they* may take the principal bearing; but, should all feet be suffering, he will, after having stood for some time in considerable pain, lie down. It is, however, the posture in which he is observed to be standing, together with the peculiarity of his gait, that proclaims at once the nature of his complaint. And this is confirmed by the intense heat felt on clasping the hoofs. The treatment must consist in abstracting blood locally from the *toe* of each inflamed foot; and in covering the hoof afterwards, if possible to obtain it, with pounded ice, by placing it within a large poultice-boot; if not, with the coldest poultice he can procure. At the same time, the coronets should be blistered. It is also advisable to purge the animal pretty briskly. The bleeding, poulticing, and blistering should be repeated at short intervals, according to circumstances. What we have to guard against, is suppuration or abscess of the foot; the natural consequence of which is spontaneous separation and casting off the hoofs, leaving the animal thereby in a miserable plight, from which it becomes a duty to humanity to release him by putting him to death.

Contracted feet. Were it not for fear of being accused of a very serious omission, we do not think we should give place, among the *diseases*, to the subject of the present paragraph; it is certainly not of itself a *disease*, unless we can consider a tight (human) shoe as one. For the hoof itself is just as insensible as a piece of leather, and no more than the said leather can become the seat or subject of diseased or any other organic action; it would therefore be the height of absurdity to regard contracted hoofs in this light. It has been said, that a hoof, when it has become contracted, is operating the same as a tight shoe, compressing and squeezing the parts within it: but this mechanical notion does not seem to accord with practice. We rather suspect that the contraction (of the hoof) will be found to be rather an *effect* than a cause of inflammation: not that we mean to assert, that it always results from inflammation; only, when we find the two existing together in a foot previously healthy, we would place the latter first in the account. The ordinary cause of contraction appears to be the state of inaction into which the posterior or compressible parts of the foot are thrown in consequence, principally, of want of pressure to the frog: these parts, from having become comparatively useless, naturally shrink, and then the hoof closes in upon them. Every hour's observation shows the truth of this view of the subject; and we learn every day, from practice, that pressure to the frog has considerable effect in dilating the heels, though it may fail, in consequence of the change of structure in the compressed, or rather shrunk parts, in restoring the hoof to its original dimensions.

Sand-crack is a cleft or crack in the hoof, commonly in the side, rarely in front, and invariably extending from above downward, in consequence of the fibres of the hoof taking that direction. The ordinary situation for sand-crack is the *side* of the hoof, the quarter just opposite to the place where the heels of the coffin bone terminate; and the reasons why it comes in this particular place is, that this is the part of the hoof which is most operated on, either by expansion or contraction. When the crack comes in front, it is in the *hind* hoof. Should the crack penetrate completely through to the sensitive parts, or should it extend to the coronary ligament, it commonly occasions lameness. All that we can do towards restoration, is to take off all bearing from the cracked part upon the shoe; and at the same time blister the coronet directly above it, in order to produce a united crust, which must grow from top to bottom before the crack can be obliterated: no sort of union can possibly take place between the horny sides of the crack.

Corn. The seat of this disease is one of the heels of the *sole* of the foot, most commonly the *inner* heel; because, that being the one which moves the most in action, is more likely to strike against the heel of the shoe, and be bruised, than the outer one. It is very erroneous to suppose that a corn in a horse bears any analogy to a corn in a man's foot: it is quite a different thing; it consists in a bruise of the sensitive parts at the heels, by which their blood-vessels become ruptured and blood exudes, which, by penetration, stains the horn with a red or pinkish spot. The remedy for corn consists in preventing the possibility of contact between the bruised part and the shoe; and in poulticing the foot, should there be inflammation existing; if not, in simply stopping it with clay or any other moist substance, the object being to soften the horn. It is very important, however, to remember that, before this is done, the corn should be pared as thin as possible.

Quittor is the name for an ulcer upon some part of the circle where the hoof and skin unite, leading to a sinus which runs downward between the hoof and the sensitive foot. Commonly, this takes place in the inner quarter, in consequence of that being a part frequently bruised by the shoe of the fellow foot; and also in consequence of the inner side being the more frequent seat of corn, of which this disease is occasionally the offset. The cure should first be attempted with caustics; and one of the best is corrosive sublimate, with the powder of which the sinus should be filled, and afterwards the foot poulticed. Should this fail, the actual cautery may be employed: with a smooth cylindrical blunt-pointed iron, heated to redness, cauterize the sinus down to its bottom, and on every side, and afterwards fill it with corrosive sublimate. Should these means fail, our only resource is to take away part of the quarter of the hoof, and excise the diseased portion of cartilage.

Frush.—This is so common a disease, and one that is so commonly unattended with any sort of suffering, or at least sufficient to occasion lameness, that many people look upon a frush as no disease at all. It consists in a fœtid issue from the cleft of the frog; which gradually rots away the horn in the immediate vicinity, until the whole of the cleft, whose cavity becomes at the same time enlarged, acquires the softness of cheese and turns into a mass of corruption of the most malignant and noisome description. In recent cases, simple astringents are all that is required. Equal parts of powdered alum and charcoal, or, of the former and double its quantity of Armenian bole: pare out the cleft, and introduce some of the powder upon a piece of tow, and renew the dressing every day. In worse cases, a small proportion of powdered blue vitriol must be added; about one part in six. Vitriol water (made by mixing one ounce of vitriol with a pint of water) is also a very good application. After the dressing is applied, in wet weather it is good practice to pour melted tar over the surface of the frog, to prevent the dirt and wet from penetrating into the cleft.

Canker.—An extremely loathsome disease, which very often has its origin in frush; at other times it is produced by grease: in fact it may originate in almost any neglected or maltreated diseased action, continuing long in the foot. It is brought on by the ichorous and putrid issues of the diseased parts corrupting the adjoining healthy parts, and at length inducing in them a malignant cancerous action, which, when once set up, spreads rapidly over the contiguous surfaces. In place of producing hoof, parts once become cancerous or cankerous, give growth to a white, soft, fungous substance, which, on being cut or pricked, readily bleeds, and would appear also from the irritability of the animal to be highly sensitive. To cure the canker, the first object should be to destroy this mordid secretory action: which is best done by *aquafortis;* with a feather dipped into the liquid, spread it over the surface; after which, cover the parts with an ointment composed of verdigrease, in powder, five ounces; vinegar, eight ounces; treacle, twelve ounces; mixed altogether and boiled over a slow fire, to the consistence of honey.

Last in order of the diseases of the foot, though perhaps first in point of importance, we place what has been unwittingly named "the *Navicular* disease:" by which is meant the navicular-*joint* disease; and under this denomination we shall describe it. For many a year have we passed off *groggy-*

horses as lame from contraction or disease in the coffin-joint: whereas, Mr. Turner (who has very recently published on the subject, in that useful and interesting journal, the Veterinarian,) has shown to demonstration to us that the disease—the *cause of lameness*—is not to be sought in the coffin, but in the *navicular* joint; and that it consists in inflammation and ulceration of the synovial membrane covering the inferior surface of the navicular bone, and the opponent part of the long flexor tendon. Mr. Turner (to whose *Paper on the subject* we must refer our reader for further *particulars*) conceives that the disease originates in contraction; not of that kind which consists in narrowing of the hoof, but such as is commonly described by the phrase "from below upwards:" meaning, a diminution in the cavity of the hoof in the *vertical* (not the lateral) line of direction. We cannot, however, subscribe to this opinion. We, for our own part, look upon it as the effect of concussion; and would rather regard contraction as, ordinarily, the *effect*, and not the cause of the malady in the joint. In regard to the symptoms denoting such disease, they may be comprehended under the phrase "grogginess" of one or both feet, and no *apparent* cause for lameness: and in regard to treatment, that is to be conducted on the principles of inflammation in general; viz. local bleeding and blistering; cold applications; rest; purgation, &c. At least such is the old mode of procedure; and it is one which the discovery of the seat and nature of the disease has gone far to confirm.

Having, with this, concluded the *local* maladies, we shall proceed to the

FOURTH CLASS.—SPECIFIC DISEASES.

Among which we may rank *Strangles*, *Mange*, *Internal Inflammation of the Eyes*, *Farcy*, and *Glanders*.

Strangles. Generally, between the 4th and 5th years, sometimes earlier, sometimes later in life, and more particularly during the vernal and autumnal seasons, the horse becomes the subject of a diffused swelling about the throat and betwixt the jaw-bones, which in the farriers' cant is denominated "strangles." (From some notion, I imagine of endangering suffocation.) *True* or *genuine strangles* are the epithets applied to the tumour, or that part of the swelling which is confined to the interspace between the branches of the jaw: this, however, is very commonly accompanied with tumefaction of the glands or kernels under the ears, and also of the parts about the throat. In the first stage, the swelling is hard, somewhat hotter to the feel than the other parts, and the animal flinches from the pressure upon it; gradually, it grows more extended and prominent, hotter and more tender to the touch, until at length one part becomes more prominent than any other, (and this is commonly the central and most dependent part,) at which place the tumour, now become an *abscess*, in consequence of containing matter, has a soft and fluctuating feel, and is thereby said to *point*. The suppurating process is commonly confined to the tumour between the jaws: in some cases, however, we have abscesses forming under the ears, and about the throat also. The specific characters of this malady (which has been on account of them compared to the small-pox in man) consist in its attacking all horses, and about the same period of their life; and in its not being liable to appear a second time in the same subject. Some writers assert, that it is a contagious disorder: but we lack proofs of this assertion. It has never seemed to us to be of such a nature.

When the strangles first appear, and the tumour is yet hard, seldom any thing is required to be done; unless we are desirous to repel it, and then we may employ a mild blister, and at the same time bleed and purge the animal. The common opinion, however, is, that this is not so beneficial a practice as that which promotes suppuration; and, therefore, we may either leave it to itself, or foment the swelling twice or thrice a-day with hot water, and apply warm poultices, composed of bran. As soon as it begins to increase much, and particularly if it is growing hot and tender or soft, we should, in the intervals of the fomentation, envelop the whole throat in a copious linseed meal poultice. The pointing process is to be closely watched, and to be considered the signal for opening the abscess: which is best done with a broad-shouldered lancet. The matter being all pressed out, spirits of turpentine is to be injected into the cavity once a-day; and afterwards the swelling is to be again fomented and poulticed, as long at least as there continues any discharge: scrupulous attention being paid in the course of cure to keep the hole open.

Mange is a well-known disorder of the skin among horses, occasioning them to rub the parts affected against any thing they happen to be standing near. It has been likened to the itch in ourselves, and not without reason; the two appearing to be extremely analogous. The disorder begins with simply an itchy and scurfy state of the skin, commonly about the head, side of the neck, withers and shoulders; sometimes the arm-pits and thighs: which parts soon afterwards exhibit bare white patches, in consequence of the outer skin (becoming dry and turning white) continually desquamating in branny scales. The next change consists in the parts becoming arid and harsh to the feel, and in their puckering into wrinkles. From the notorious fact of mange being a *contagious* disease, any one would suppose that it was always produced by that influence: there appears, however, great reason to believe that it arises in many cases *spontaneously;* and still more to show that *poverty* is one grand cause of its origin.

Very many recipes have been handed down to us as *cures* for this readily curable disorder. The two following we can recommend. Take of sulphur vivum 6 oz.; train oil 1 pint; stir them together, and add 2 oz. of Venice turpentine. Or this: take of sulphur vivum 4 oz.; powdered hellebore 2 oz.; sublimate 1 dr.; first mix these powdered ingredients together, and afterwards stir them into a pint of train oil. With either of these applications, the parts affected are to be well rubbed. On the third day following, wash them; and afterwards repeat the dressing the same as before: and continue this plan until the cure is completed.

INFLAMMATION OF THE EYES. The eye may become inflamed from injury of any kind; such as a blow with a whip or stick, or the accidental admission into it of hay-seed, dust or dirt, &c. The immediate effect of any one of such like irritating substances, is a flow of tears, the simultaneous ejection of the haw over the eye, together with partial or entire closure of the eyelid; and this state continues so long as the irritant remains. It is therefore necessary, before any other step be taken, to extract the hayseed or piece of dirt, or whatever it may be; which done, foment the eye well with warm water. The inflammation which follows (should any ensue) must be met by bleeding, either from the eye-vein or from the jugular of the *same* side; by a dose of physic; and by continuing the fomentations, which may now be mixed with decoction of poppies.

THE SPECIFIC INFLAMMATION OF THE EYES, or (as the farriers phrase it) "*the moon blindness*," it is which we have to dread. It would appear that this disease made its attack during the night; for it commonly happens that the groom discovers "the bad eye" the first thing in the morning. The eye has either a heavy gloomy aspect, and seems smaller than the other, from the circumstance of the drooping of the upper lid, or it is quite shut up; the haw projects, and the tears wet in their overflow the under lid. All this leads the groom to imagine that the horse must have *hurt* his eye somehow or other in the course of the past night. On looking into the eye, it is found to be so dull and muddy, that we can hardly discriminate any thing; its hue is evidently changed, being of another shade, and lacking lustre when compared with the eye in health. This disorder is one of the injurious consequences of warm and foul stabling. It is *periodical* in its course; leaving the eye for a month or more, and then returning, or else attacking the other one, which has been until then in health: from observing this curious circumstance it was that the old farriers denominated it *moon* or *lunatic* blindness.

The treatment hitherto found most adapted to this destructive malady (for it is one which seems to set our art almost at defiance) consists in drawing a large quantity of blood from the side of the neck corresponding to the affected eye; in briskly purging; in inserting a rowel under the jaw; and in using the poppy fomentation to the eye. As soon as the inflammatory action is on the decline, we may use simply cold spring water, or goulard-water to the eye, and occasionally drop into it a little of the vinum opii, and succeed that by the use of salt or white vitriol water, in the proportion of an ounce of the former or a dram of the latter to a pint measure. To remove any remaining opacity, salt finely powdered, or sugar or glass may be blown into the eye once a-day. Although after this manner, we may seem to subdue or parry off a first, and even a second attack: still will the disorder in all probability, sooner or later return, and in the end almost to a certainty be productive of blindness.

FARCY is a well-known disease, consisting in chains of lumps or ulcerations of the skin, with or without swellings of the limbs or other parts in which they are seated. It is remarked that farcy mostly breaks out in those parts where the skin is thinnest, which accounts for its commonly attacking the inside of the thigh; but the pathological or true explanation of this is, that along those parts take their course the absorbent vessels, in which (and not in the *veins*) the disease is seated. The ordinary appearances of farcy are chords of lumpy or knotty swellings under the skin, taking the course of the superficial veins, which chords are traceable into large kernels or glandular tumours either in the groin or breast, or else under the jaw, according as the disease affects the hind or fore leg, or the side of the head. The knots (which by the farriers are denominated *farcy-buds*) are at first hard to the feel, and give little or no sensibility on pressure, so that the animal suffers you to handle and squeeze them; but by degrees they acquire tenderness, inflame, feel hotter than the skin surrounding them, and at length begin to grow soft; at which period they also swell in bulk, and eventually burst, and give issue to a purulent matter. The lumps, after they have burst, leave behind them, a chain of small, circular, nasty, foul sores. Should the hind or fore leg be farcical, the entire limb becomes swollen, hot, and tender, according to the progress the disease makes; the head or neck, or any other part similarly affected, will likewise become tumefied. In some cases, the farcied parts become dropsical: the skin, which is often prodigiously puffed up, acquires a soft doughy feel; which anomaly of common or ordinary farcy, the farriers have named *watery farcy*.

In the first instance, farcy, particularly if the attack be a violent one, should be met by bleeding and purging; after which it is most successfully treated by *tonics*. Having well cleared out the body, administer every day from half an ounce to an ounce of green vitriol, and ten grains of corrosive sublimate, made into a ball with half an ounce of Venice turpentine. Exercise, good air, and nutritious diet, will be found to be useful auxiliaries. In regard to the local treatment, should the chorded parts be hard and insensible to the feel, blister them; and that will probably disperse them: if not, it will promote the suppurative action. As soon as the knots have burst, apply a heated "budding" iron to them (which is an iron made with a blunt conical point,) so as to destroy the diseased surfaces, and dispose them to take on healthy action. Afterwards, in the progress of their healing, they may be dressed with a solution of blue vitriol, or else an alum lotion.

GLANDERS. This is the last disease it is our intention to give, and it is the most formidable of all: in fact, it is justly said to form the *opprobrium* of the veterinarian's art. And what renders this a matter of surprise to an indifferent observer, is, that glanders is an affection which in the generality of cases, for some considerable time does not appear to detract in the slightest degree from the animal's ordinary state of health: and so far is it, while it continues in this passive stage, from lowering his condition, that he not only continues to enjoy health, but, from the state of inactivity into which he is probably thrown in consequence, absolutely gets fat; hence it is we hear people say, that it seems impossible, under such circumstances, their horses can be diseased. Most writers make a division of glanders into *acute* and *chronic:* the former being that which, when once set in action, proceeds regularly through its course, and at last ends in destruction; the latter, a stage in which the disease appears to be stationary, or at all events one in which it makes no perceptible inroad upon the general health.

Acute Glanders consists in an ulceration of a peculiar character of the pituatury membrane (the membrane lining the cavities of the nose), which is commonly accompanied with glandular swellings under the jaws. These ulcerations at first assume the appearance of pin-holes, only that they are shallow, instead of deep, and have thin indented edges; they exude a purulent matter, which so completely envelopes them, that their true character cannot be well made out until their surfaces are wiped dry. They exist in most numbers upon the middle or partition of the nose; but they are also often found grouped in the hollow within the doubling of the nostril. By interunion, one with another, they at length form broad ulcerous patches, which grow deeper and deeper until they threaten destruction to the septum nasi and turbinated bones: a period at which the sloughing and suppurative action is occasioning so much defluxion that there is always danger of suffocation; which is, in fact, the common way acute glanders ends in death.

Chronic Glanders consists in a purulent ill-conditioned discharge from the nose, commonly but from one nostril: this is also the case in the acute form; but it is not so *generally* confined to one side of the head as the chronic. The difference between the two is, that in the chronic there is *no* ulceration. The source of this affection is the frontal sinus: if that be opened with a common gimblet, and a feather, introduced into the hole, be withdrawn smeared with *matter*, we may be certain the disease exists.

On the subject of a remedy for glanders, we have but little to offer; and that little, even, is not of a very satisfactory nature. In respect to *acute* glanders, it is considered, and in the present state of our knowledge wisely so, too, as the signal for the destruction of the animal. Of chronic glanders, many cases have been known to recover; and many of these have appeared to derive their benefit from treatment. We would recommend some tonic or astringent medicine, internally, such as either blue or green vitriol, given in the form of drink; the former in doses of six drams daily, the latter of one ounce: also, we would advise, that the tumours under the jaws be blistered; and the affected nostril and sinus injected with either a solution of alum, zinc, or blue vitriol.

Glanders being a contagious malady, it will be necessary to separate the subject apart from all other horses. We believe, however, that actual contact of the matter with an abraded, or at least *bare* surface, is necessary for its communication: therefore the danger does not appear to be so great as many are apt to imagine. Notwithstanding, we deem it prudent to take this precaution.

We shall conclude this article with some observations on the subject of

AGE,

Or the art of numbering the years of a horse's life by the appearances presented by his teeth.

The foal may be said to come into the world *toothless;* at least, he shows none of those teeth which, in after years, become the criteria of age; to wit, the *incisive teeth* and the *tusks.* To make use of a phrase well understood among medical men, the foal at birth is only *in the act of cutting* twelve of his *grinders;* three in each jaw. Although he *shows* no front teeth, he nevertheless possesses them; they being buried, ready-formed, within the jaws, and now about to pierce the gums, which are, in consequence thereof, more prominent in those places than elsewhere.

About the expiration of the first week after birth, or in the course of the second, the front incisive teeth cut the gums; and these are succeeded, in the course of the fourth or fifth week, by the middle teeth, which spring up on their sides: the teeth in the upper jaw making their appearance commonly before those in the lower,—a remark that applies to the cutting of the teeth in general. So that if you, on distracting a colt's lips, find that he has only four nippers, two in each jaw, you will know that he is a week old, as is represented by Fig. 1, Plate DXXXII.; on the other hand, if, instead of four, he possesses eight teeth, you may know he has been dropped at least a month. *Vide* Fig. 2.

By the time the foal begins to look about for food of a more substantial kind than that afforded by its dam, these four teeth have made sufficient progress to enable the animal to nip off its pasture and browse, or gather up dry provender ready cut for it: also, about this period—about the sixth or seventh month—the corner teeth make their exit; and by growing and forming a line with the others, complete the colt's set of incisors. *Vide* Fig. 3.

These (colt's) teeth continue to serve the animal until after he has completed his second year; and they remain all this time, to a casual or superficial observation, without any change or alteration: if, however, we will only take the trouble to compare the teeth of an yearling with that of a two-year-old colt, we shall discover ample marks of distinction to enable us to pronounce, without fear of being in error, whether the colt be one or two years of age. The Figs. 3 and 4 will serve to demonstrate this difference. It will be seen in the former that the teeth are represented as possessing large, open, deep pits upon their surfaces, which denote their imperfect formation; whereas, in the latter figure, the teeth (particularly the two in the middle) possess nothing but contracted faint black marks, showing the situations of the original pits, now filled up by a process of growth and consummation. When, therefore, we come to make a calculation grounded on the progress of growth, as indicated by these changes, and take into our account the general law of dating every horse's age from the first of May, (without any reference to the day or month in which he was foaled) we shall experience no difficulty in numbering his months as well as his years.

Between the second and third years, the "*shedding process*," as it is phrased, commences; *i. e.* the colt's teeth, in consequence of absorption of their fangs or roots, gradually lose their hold, and at length fall out, to make room for the permanent or horse's teeth, which are springing up underneath them. The *front teeth* are the first to make this change; and they are found regularly to do so as the animal approaches his third year: so that as soon as they have made their appearance, we know that the colt is either close approaching or past his third year, dependent upon the month of May being either past or to come. *Vide* Fig. 5.

Between the third and fourth years, *the middle teeth* undergo the same changes; and between the fourth and fifth years, *the corner teeth:* so that the animal is readily pronounced to be in his fourth or fifth year, according as he has six or eight horse's teeth. *Vide* Figs. 6 and 7. In addition to which, as a further confirmation of his age (were any required), the tusks commonly make their appearance about the fifth year; as is shown by Fig. 7.

The fifth year being the period at which the animal is provided with his full set of permanent teeth, we are henceforth compelled, in order to judge of his age in after years, to seek for other signs: and observation and experience have taught us, that such are to be met with in the alterations which the teeth themselves undergo; and further, that these marks of age are hardly less unequivocal than those afforded by the shedding process. The alterations alluded to are more particularly demonstrable upon the wearing surfaces or *faces* of the incisive teeth; and they take place with such regularity, year after year, that we are enabled, by comparison of one with another, to come to pretty correct conclusions. A fresh-cut tooth, for example, exhibits upon its face a wide open pit, the elliptical border around which is prominent and rather sharp, anteriorly; but low and defective, posteriorly. During the first year afterwards, the border all around the pit attains the same level, and subsequently becomes worn down so as to exhibit two prominent white elliptical rings surrounding the pit, which itself very gradually contracts and fills up, and acquires internally a black aspect; which has given rise to the appellation of *bean* or *mark*. In the course of the second year, the rims become worn down smooth and level with the surface, and the pit, though still well marked, grows evidently narrower and shallower. In the third year from its eruption, the tooth exhibits but faint vestiges of the white rims; the pit becomes filled up, and the black mark in its middle converted into a mere stripe, or it may be altogether effaced.

Such are the different aspects which the face of the tooth assumes in the course of the three years following its eruption from the jaw; and it must be evident to our reader, from what has been said heretofore, that the different teeth must undergo these alterations during different years of the animal's life. For example, *the front teeth*, being cut on the third year, will assume them successively on the 4th, 5th, and 6th; *the middle teeth*, on the 5th, 6th, and 7th, in consequence of not being cut until the year after the former; and the corner teeth, on the 6th, 7th, and 8th years. On the completion of the 9th year, the white rims are hardly visible, the pits are all filled up, and the marks nearly or quite obliterated. At least, such is the general course of these changes; as will be seen by a reference to the Figs. 5, 6, 7, 8, 9, 10, in Plate DXXXII.

Some horses preserve the beans or marks for a very long period; occasionally, even through life: nevertheless, the pits are completely filled up, and the face is in every respect perfect.

Concerning the dental indications of age after the 9th year, we cannot do better than present our reader with an extract from Lafosse's work on Veterinary Medicine; accompanying it only with this single remark, that although the theory is highly ingenious, and does much credit to its observant author, the changes are too liable to irregularity and variation to have *implicit* reliance placed upon them.

"In order to tell the age of a horse that has passed his 8th year, we must know that an incisive tooth, (considered as a whole) when extracted from its socket, is of a curved pyramidal figure, and, while fixed within the jaw, the part exterior to the gum presents an oval outline, thus ⬭; of which form it continues until the 10th or 11th year. After this it begins to take on, and about the 14th year fully assumes the circular figure, ○. From the 14th to the 17th year, it grows triangular. And from this period inclines to, and ever afterwards retains, an oval figure turned contrariwise from its original form, 0."

Those who may feel desirous to prosecute their inquiries into this and other departments of veterinary knowledge, will consult with most advantage, among the English writers, Coleman, Clarke, Blaine, and Percivall; among the French, Lafosse, Girard, and Hurtrel d'Arboval.

EXPLANATION OF PLATE DXXX.

The entire skeleton is divided into Trunk, Head, and Extremities.

The Trunk comprises the spine, the thorax, and the pelvis.

The Spine includes the long chain of bones extending from the head to the tail.

The Neck is composed of seven cervical vertebræ, numbered from 1 to 7.

The Back is composed of eighteen dorsal vertebræ, numbered from 1 to 18.

The Loins are composed of five lumbar vertebræ, numbered from 1 to 5.

The tail is composed of fifteen pieces, (very like vertebræ) numbered from 1 to 15.

The Thorax, formed by the ribs *a*, *a*, *a*, *a*, and the *Sternum* or *Breastbone*, *b*, *b*, *b*.

The Pelvis, formed by the *Sacrum* or *Rump-bone*, *c*, *c*, *c*, *c*, *c*; the two hip-bones, *d*, *d*; and the *Coccyx* or *Tail*.

The Head, the second division of the skeleton, comprehends the cranium and the face.

The Cranium, *Skull*, or brain-case, is composed of ten bones, or separable pieces; six of which are visible in the Plate, viz. the frontal, *f*, *f*, the parietal, *p*, *p*, the temporal, *t*, *t*, and the occipital, *o*, *o*.

The Face is composed of seventeen bones; of which may be seen in the Plate—the nasal bones, *n*, *n*; the superior maxillary, M, M; the anterior maxillary, *m*, *m*; the malar *r*, *r*; the lachrymal, *l*, *l*; and inferior maxillary bone, or lower jaw, J, J. Also the teeth.

The Extremities are, two *fore*, and two *hind*.

The Fore Extremity comprises the shoulder, composed of the scapula or blade bone, *a*, *a*; and the humerus, *b*, *b*; the arm-bone, *c*, *c*; the six bones of the knee, *d*, *d*; the seventh, behind the others, *e*; the cannon, or metacarpal bone, *h*, *h*; the sesamoids, *g*, *g*; the pastern bone, *k*, *k*; the coronet bone, *o*, *o*; the coffin, *m*, *m*; and the navicular bone, *n*, *n*.

The Hind Extremity comprises—the haunch, composed of the femoral or haunch bone, *a*, *a*; and the patella, or stifle bone, *b*, *b*;—the thigh, formed by the tibia, the veritable thigh-bone of the horse, *c*, *c*;—the hock, *d*, *d*; consisting of six small bones; the os calcis, or hock-bone, projecting behind, *e*, *e*; and the leg, and parts below, which are the same as those of the fore extremity.

EXPLANATION OF PLATE DXXXI.

Fig. 1. Represents the ground or wearing surface of the ordinary horse-shoe.

Fig. 2. Shows the upper, or foot-surface of the same shoe, and also a clip or turn up at the toe, which materially assists in its fixture.

Fig. 3. Represents another and preferable description of foot-surface,—the one known by the name of the *seated shoe.*

Fig. 4. The tip.

Fig. 5. The jointed shoe—a shoe with a joint or hinge at the toe.

Fig. 6. The French shoe.

Fig. 7. The Persian, Tuskish, and Arabian shoe.

Fig. 8. The Barbary shoe.

Fig. 9. The bar-shoe.

Fig. 10. The patten-shoe.

Fig. 11. The screw-shoe.

Fig. 12. Represents the ground-surface of an ordinary hind-shoe. The outer heel is made with a *caulking* or stop, to prevent the animal from slipping; the inner heel is increased to double the thickness of the other part of the web, in order to preserve the level of the tread, which the caulking would otherwise incline to one side.

EXPLANATION OF PLATE DXXXII.

Fig. 1. Represents a section of the lower jaw of a colt, the second week after birth.

Fig. 2. A similar section, one month after birth.

Fig. 3. A similar section, between the sixth and tenth month.

Fig. 4. Shows the alterations the teeth of the colt undergo in the course of the second year.

Fig. 5. The appearance of the jaw at the third year, when it contains two horse-teeth.

Fig. 6. A jaw containing four horse-teeth, showing the animal to be in his fourth year.

Fig. 7. The jaw complete with six horse-teeth, and two tusks, as it is in the fifth year.

Fig. 8. Representing the appearance of the sixth year—the front teeth undergoing their *third* change; the middle only their *second.*

Fig. 9. The seventh year;—the middle teeth undergoing their *third* change; the corner teeth their *second.*

Fig. 10. The eighth year;—the corner teeth undergoing their third change: the pits in the others almost or quite obliterated.

VEVAY, the ancient *Vibiscum*, is a town of Switzerland in the canton of Bern. It stands on the river Vevaise, which is crossed by a fine stone bridge, on a plain at the foot of the mountains on the north margin of the Lake of Geneva. It is neat and well built. In the large market place is the Halle au Bled, which has a square colonnade of eight fine stone pillars in front, and six on each side. The cathedral stands on an eminence behind the town, commanding a fine view of the Lake of Geneva. It has a large square tower, but is a plain building. Its chief manufactures are hats, watches, and jewellery. Population about 3800. East Lon. 6° 48′. North Lat. 46° 30′.

VIA MALA, the name of a defile in the Grisons, stretching from Toulis to Zilis, a distance of two leagues. The former badness of the road, and the deepness of its gloom, seem to have been the cause of its name. It runs through a dark and solitary valley, covered in many places with thick forests, which admit only a kind of faint light, and it is so narrow that the steep overhanging rocks meet almost with their summits. The Rhine foams at the bottom, but is scarcely visible. About three miles from its commencement, a stone bridge of a single arch is thrown across a gulf. The scenery is here very grand. "The Rhine," says Mr. Coxe, "falls into a beautiful cascade, rolls in a narrow channel, at the depth of about 400 feet, furiously dashes under the bridge, expands itself into a wide basin, and then is lost under a rock through which it has pierced a passage. The impending mountains, partly bare, and partly embosomed with fir, cast an awful gloom over the gulf beneath. The Rhine, which is at present above 400 feet below the bridge, seems to have once flowed as high, or even higher, than the present bridge, having worn away the rock, and excavated the deep channel in which it now runs." See Coxe's *Travels in Switzerland*, vol. iii. p. 163.

VIBRATION. See ACOUSTICS, Vol. I. p. 118, and SCIENCE, *Curiosities in*, Vol. XVII.

VICENZA, a city of Austrian Italy, and capital of the Vicentin, is agreeable situated between two mountains, at the junction of two rivers, one of which, the Bacchiglione, crossed by bridges, (the most interesting of which is the bridge Della Barche) flows through the town. It is about *four* Italian miles in circuit, and is encircled with a double wall, and defended by a fort. Some of the streets are spacious, and the houses are in general regularly built. The market-place is of an oblong form, and is adorned with the town-house, which has a very elegant front. The public buildings of this city, of which nearly twenty were designed by Palladio, are of remarkable elegance, and of these the town-house is particularly remarkable. The Olympic Theatre, built at the expense of a society, in the ancient Roman taste, is considered by many persons as the finest specimen of modern architecture in Italy. The other buildings are the Ragione or Palace of Justice, the Palace del Capitanio, the palace of Chiericati, the Rotundo of the Casa Capra, and the gate of the Campus Martius. The cathedral, which has a subterranean church below the choir, is large, but is encumbered with adjoining houses. The church Della Gratia, is the work of Palladio. The other churches are, that of the Dominicans, that of St. Laurent, that of St. Micheli, and that of the Madonna del Monte without the city. Vicenza does not contain many Roman antiquities. In the gardens of Battistelli are the ruins of a theatre; there are also three arches of an aqueduct, a statue of Iphigenia, and the remains of the imperial palace.

There is here a Lyceum. Silk is the chief article of manufacture, besides woollen goods and leather. The hills called the Colles Berici, in the neighbourhood, contain some natural grottoes of great extent and variety. For some distance around the city there are various villas and magnificent edifices. Among the former is the villa called the Rotunda, an exquisite edifice of Palladio's; and among the latter the staircase and portico that lead to the church on Monte Berico. This staircase consists of nearly 200 steps, with 35 resting places, all of stone, extending from the town to the summit of the hill. The portico is a noble gallery leading to the church. It is built of stone, and is more than a mile long. The church is of the Corinthian order, like a Greek cross, with a dome in the centre. Population about 30,000. See Eustace's *Tour through Italy*, vol. i. p. 44.

VIENNA, the capital of the Austrian empire, is situated in the circle of Austria, on the right bank of the Danube. It is denominated Wienne in German, from a small stream of that name, which, running through it, falls into the Danube. This latter river, though rapid in its course both above and below, is here extremely slow, and is studded with a number of beautiful islands; and it is on a branch of it, formed by these islands, and not on the main stream, that the capital stands. This branch, though small, is sufficiently large for the purposes of inland navigation. The Wienne, instead of being an ornament or conducive to cleanliness, has, on account of its smallness, a contrary tendency, being filled with the accumulated refuse of the city. Vienna is built on a plain, only 460 feet above the level of the sea.

Vienna stands on the site of the ancient *Vindobona*, a fortified station situated in the ancient *Pannonia*. It at length shared the fate of the Roman empire. Charlemagne added it to his dominions; at which time, and for several centuries afterwards, it was of very inconsiderable extent; the church of St. Stephen, now nearly in the centre, was, when built in 1144, outside the walls. Few capitals have undergone so many sieges, or have been so often taken; events of which it is not at present necessary to give an account. The most celebrated siege was in 1683 by the Turks under the command of Mustapha, son-in-law of Mahomet IV. who, when on the verge of being master of the city, was nobly repulsed by John Sobieski, king of Poland; and thus not only Vienna, but Christendom, were saved from the imminent danger that threatened them. (See the article POLAND.) This capital was taken by Bonaparte both in 1805 and 1809. The Congress held here by the allied sovereigns, on the downfall of that illustrious conqueror, is well known.

This city is singularly built. "It forms," says Dr. Walsh, "three concentrical circles; the first is the old city, surrounded by its wall and rampart; the next is a plain called the Glacis, which forms a circle of gardens and pleasure grounds; and the third is the suburbs, an immense circle of houses enclosing within it the other two." (*Journey from Constantinople*, 382.) The old city does not extend above three miles in circumference. It can boast of no fewer than 18 squares, and it contains 120 streets; all of which, though narrow and crooked, are clean, well paved, and well lighted; and common sewers abound. The pavement, however, is so little elevated above the causeway, that the pedestrian is not sufficiently protected. Nor is this the only inconvenience to which such persons are exposed. A great part, often the half of the street, is rendered useless by heaps of wood, the fuel of the inhabitants. This wood, being brought into the city in logs from three to four feet long, is laid down on the street to be cut into smaller pieces, before it is deposited in the cellar. In this way, it not unfrequently happens that from the piling up of such wood on both sides of the street, nothing remains free but the centre; a state of things most unfavourable to the foot passenger, but the difficulties of which the Austrian coachmen avoid with a dexterity peculiar to themselves. The houses are in general built of brick, and roofed with slate. They are of great height, and, like those of Edinburgh and Paris, enter by a common stair. Several families, accordingly, live under the same roof, the number of inhabitants to each house averaging forty. The most of the squares are adorned with fountains or other monuments, though not always very elegantly executed. The statue of Joseph II. decorates a square which bears his name. The Graben's square, about the centre of the city, is a more fashionable resort than any other: in it are situated the principal shops and warehouses, as also in the Kohlmark, a large and well-built street that leads to it. Among all the statues and sculptured embellishments with which Austria abounds, the want of memorials in honour of great men is much felt; no such memorials occur, except that of Joseph II. The city, it may here be mentioned, is, or rather was, encompassed by ditches and ramparts, and communicated with the suburbs by 12 gates. Promenading is the only purpose to which these fortifications are now applied; a purpose for which, from their breadth and elevation, they are well adapted. Together with the Glacis, which we now proceed to describe, they form the great scene of recreation and amusement, abounding with coffee-houses and other places of entertainment.

"The Glacis, the circular space of ground which, as before stated, stretches out immediately from the foot of the ramparts, and encircles the city, except where the walls are washed by the arm of the Danube, is," to use the words of a modern traveller, "no longer the naked and cheerless stripe which it used to be. Much of it has been formed into gardens belonging to different branches of the imperial family; the whole has been gradually planted and laid out into alleys; and in 1822 the emperor, in his love for his subjects, allowed a coffee-house to be built among the trees. Beyond the Glacis, the ground in general rises; and along these eminences stretch the suburbs of Vienna, surrounding the city like the outworks of some huge fortification, and finally surrounded themselves by a brick wall, a mere instrument of police, to ensure the detection of radical and contraband goods, by subjecting every thing and every person to a strict examination." (Russell's *Tour in Germany*, ii. 250.) The suburbs occupy more ground than the old city, partly because cultivated fields or large gardens occasionally intervene; they are also more irregularly built; but the houses are in general distinguished by great elegance. Most of them are private property; and most of the wealthy and most distinguished persons connected with the city, such as Prince Lichtenstein and Prince Esterhazy, have residences there, like palaces, with gardens and picture galleries. These suburbs, 34 in number, are known by different names, and are of all different sizes; the Leopoldstadt, situated on an island, is the largest, containing 600 houses; while the smallest contain only eleven houses. The streets in the suburbs are either not paved at all, or ill paved; on which account clouds of dust and sand, when a high wind prevails, envelope the whole city.

The ramparts have already been mentioned as forming a public walk. But the most celebrated place of this kind is the Prater, which has been characterised as the finest public park in Europe. "It has more rural beauty than Hyde Park; and surely the more varied and natural arrangement of its woods and waters is preferable to the formal basins and alleys of the garden of the Thuilleries." (*Tour in Germany*, ii, 254.) It is situated in the Leopoldstadt. It is bounded on three sides by water. It consists of a thick forest of oaks, elms, and chesnuts, diverging into five alleys, and opening into several lawns of fine turf. Coffee-houses are erected along the walks. The Augarten, another place of public resort, is contiguous to the Prater. The Brigitten-au is another agreeable walk; but neither of them can stand comparison with the one we have just been describing. It may here be stated that, in addition to these walks, the inhabitants of Vienna frequent the theatres, of which there are five; two in the city, and three in the suburbs; but the dramatic art has not yet attained to great perfection in this capital. As connected with the amusements of the people, we may also mention that the number of coffee-houses amount to 70, the taverns and ordinaries to 300.

The public buildings of Vienna, though any thing but splendid, must not be passed over in silence. The Bourg, an imperial palace, is undoubtedly the finest edifice in the city. Having been built at different periods, its exterior presents an irregular whimsical appearance, unworthy of a palace. The emperor inhabits that part of it called the Schweitzenhof. But though in its outward characteristics, it is not elegant, its interior is highly interesting, containing collections more valuable, it has been supposed, than any other of a similar kind in Europe. Among other articles, are mentioned a great many bronze figures, statues, and jewels of different kinds, 500 Etruscan vases, 400 ancient lamps, 32,000 gold and silver medals. In the immediate neighbourhood of the palace, are the imperial chancery and the imperial library. The other public buildings are the mint, the bank, the university, the war-office, the assembly-room, called the Hall of Apollo, and said to be capable of containing 10,000 people; the Belvidere, a palace built by Prince Eugene, now the property of the Emperor, chiefly remarkable for its gallery of valuable paintings. In one of the public buildings, namely, the town arsenal, is preserved the head of Mustapha, who commanded the Turkish army at the blockade of Vienna in 1683, and who was strangled at Belgrade in the following year. The number of elegant private houses is very great, though such houses are not unfrequently placed in the very neighbourhood of the residences of the poorer classes. Vienna can boast among its permanent inhabitants of 20 princes, 70 counts, and 50 barons.

With regard to churches, the three principal are those of St. Peter, St. Augustine, and St. Stephen. The first is built after the model of the famous one of the same name at Rome; the second contains the most interesting monument in Vienna, that erected to the memory of the Arch-duchess Maria Christina by her husband, and considered one of the master-pieces of Canova, by whom it was executed. St. Stephen's, the largest church in the Austrian dominions, is the metropolitan one: it was built in the 13th century, is 340 feet in length, 220 in breadth, and 80 in height. The tower is considered as 430 above the ground: it supports a bell weighing 18 tons, made of the cannon taken from the Turks after they were forced to raise the siege of Vienna. The only other churches deserving of notice are those of St. Charles, the most regular in the city, and St. Michael's. The whole number, exclusive of private chapels, is fifty-seven, twenty in the old city, and thirty-seven in the suburbs.

As connected with the church, the charitable institutions naturally come to be considered; and they are numerous, richly endowed, and well kept. The infirmary, situated in the suburbs, contains 2000 beds, and is remarkable for the cleanliness of its management. There is a military hospital, as also hospitals for foundlings, orphans, and aged persons. There is a work-house, a receptacle for vagrants not accused of any crime, an institution for the deaf and dumb, lying-in-hospitals, &c. Mendicity is not permitted.

Literary institutions are also sufficiently abundant. There is a university, founded so long ago as the year 1237, and which has of late become the best medical school in Germany. There are 79 professors, and 1200 students, the classes embracing every department of literature, science, and theology. Connected with the university are a botanical garden, a military hospital, an anatomical theatre, an observatory, and a veterinary school. The other numerous seminaries are also in a most efficient state. In the polytechnic school is taught whatever relates to the useful arts, different kinds of industry, and commerce. There are a seminary for the oriental languages, an academy of arts, a military school, five schools for training teachers for provincial towns and villages, seminaries for the children of the nobility, 60 schools for the lower orders, and several charity schools. The daughters of the wealthier citizens are educated in convents, but an imperial seminary has lately been founded for the daughters of officers. Attached to the principal seminaries are museums and collections, illustrative of the arts and sciences taught in them. Notwithstanding, however, the number and efficient state of the various seminaries of education, literature is not in a very flourishing state. There are only 25 printing offices, and 30 booksellers; a scale far inferior to that of Edinburgh, London, and Paris. The press labours under a severe censorship. Even foreign works, particularly Journals, are not admitted till the censor has given his sanction. There are only 30 newspapers in the whole Austrian dominions: of which five belong to the capital; the *Austrian Observer*, published daily, and constituting the organ of government, being the best known. Vienna possesses a good many literary journals, but with one exception, that of *The Annals of Literature* (*Jahrbucher der Literature*), they are of very inferior character.

Vienna is not remarkable for any thing so much as the number and extent of its public libraries and picture galleries. The imperial library contains 300,000 volumes, of which 6000 are specimens of early printing, and 12,000 are MSS. In the same library are 8,000 volumes of engravings, and 217 volumes of portraits. The university library consists of 100,000 volumes. The collections at the Bourg and the Belvidere have already been mentioned. In the musical school there is a library of works, both historical and theoretical, relative to music, many MSS. on the same subject, and an extensive collection of ancient and modern musical instruments. There is an institution for obtaining casts of statues and other antiquities, of which the originals cannot be procured. Besides these, the various seminaries of education, as already mentioned, are possessed of libraries and collections, more or less extensive, in the various departments to which these institutions belong.

The trade and manufactures of Vienna come next to be considered: and these are very considerable.—60,000 individuals are calculated to find employment in different branches of productive industry. Their manufactures embrace silk, gold and silver lace, ribbons, hardware goods, and philosophical instruments. The carriages of Vienna are much prized. Its porcelain works are very extensive, as also founderies for cannon and muskets, of the latter of which 30,000 are annually exported from the imperial manufactory. Under these circumstances, this capital must be a place of considerable trade. The exportation of its industry furnishes cargoes to 6000 boats, and merchandise for nearly 2,000,000 of wagons. The Danube, which is navigable on both sides, forms the great outlet. Were canals constructed, the commercial importance of Vienna would increase extremely. Three fairs are held in the town; and the number of mercantile houses of all kinds amounts to nearly a thousand.

The climate of Vienna is variable, and the city being on a plain, is remarkable for its humidity. The water is not good, and is often found to disagree with strangers. Rheumatism, consumption, and gout are the prevalent diseases.

The character of the inhabitants only remains to draw our attention. The number of the nobility and wealthy families render, as already hinted, many places of amusement necessary: and the poor in this respect have caught the contagion. The luxury of the table is much attended to. Literature and science, notwithstanding the numerous seminaries, are not much cultivated: music has been studied with great assiduity and success, and in nothing are the Vienese more eminent than for their proficiency in this art. They are a gay, thoughtless people; the domestic virtues, either by male or female, are not much cherished. However, they strictly observe religious ordinances, and are free from credulity, superstition, and bigotry. The established religion is the Roman Catholic; but every other form is tolerated. There are three protestant churches, two Greek ones, and two synagogues. The number of inhabitants has been variously stated; but it has been lately ascertained not to exceed 250,000.—(*Malte Brun*, vol. vii. p. 494.)

See the article Austria; the various books of *Travels* connected with the subject, particularly Riesbeck's *Travels;* Wraxall's *Memoirs;* Moore's *View of Society in France, Switzerland, and Germany;* Russell's *Tour.* See also Malte Brun's *Geography*, vol. vii. and *Alphabetisch Topographisches*, by M. F. Thielen, Vienna, 1827. (t. m.)

VIENNE, a department in the west of France. Its superficial extent is about 2800 square miles, or 689,083 hectares. Its rivers are the Vienne, the Charente, the Dive, the Clair, and the Creuse. The soil is not good; its productions are corn, fruits, potatoes, hemp, flax, and wine. The lower classes live chiefly on chesnuts. Its minerals are iron and marble. It has but few manufactures. Poitiers is the capital. Population in 1827, 267,670.

VIENNE, Upper, a department in the west of France. Its area is about 2230 miles, or 558,078 hectares. It is mountainous, producing little corn, with extensive pastures. Its minerals are marble, coal, iron, lead, and antimony. The manufactures are coarse woollens, nails, paper, and wax. Limoges is the capital. Population in 1827, 272,330.

VIENNE, a town of France, in the department of the Isere, situated on the left bank of the Rhone. The streets are steep and narrow, but the town has lately undergone considerable improvements. It has a handsome cathedral, dedicated to St. Maurice, and containing the fine tomb of Montmorin, and that of Jerom de Villars, and two good churches, a theatre, a lyceum, a free drawing school, and a museum rich in antiquities. Vienne possesses several interesting antiquities, among which are a square building like that of Nismes, supposed to have been a Roman temple. It is called the temple of Augustus, and is 60 feet long by 40 wide. There are here also the remains of a theatre and amphitheatre, traces of aqueducts, arcades, probably belonging to a triumphal arch, the pillars of an ancient Roman bridge, and a pedestal with an entablature, supposed to have been a monument. Mosaics, relievos, and marbles occur in various parts of the town; and bronzes, medals, and fragments of columns and statues are frequently dug up. The manufactures of Vienne are woollen and linen goods, leather, hardware, and coloured paper. Population 10,000. See Fisher's *Travels to the Hyeres*, Let. iv. and Millin's *Travels*, chap. xx.

VILLA RICA, a town of Brazil, and capital of the province of Minas Gheraes, situated on a steep and lofty eminence, connected with a chain of elevations, of which it is the principal. It was once a place of great importance and wealth, but from the diminution in the produce of the mines, it retains little of its former splendour. The population is about 20,000. See Maw's *Travels in Brazil*, p. 171, and our article Brazil.

VINCENT, St., one of the Caribbee Islands, is about 40 miles long and 10 broad. The island contains 84,000 acres, which are well watered. The general aspect of the country is mountainous and rugged, the intermediate valleys being very fertile, and consisting of a fine mould of sand and clay. The subjects of Great Britain possess about 24,000 acres, and nearly the same quantity is held by Charibs, the remainder being considered incapable of improvement. In 1800, the island was divided into four parishes, St. David's, St. Patrick's, St. Andrew's, and St. George's. It has only two towns, Kingston, the capital, and Richmond, the other places being merely villages at the landing places. The dependent islands are Bequei, containing 3700 acres, Union, containing 2150 acres, Canouane, with 1777 acres, and Mustique, with 1200, beside a small island called Admiralty Bay, with a commodious bay. The small islets are Little Martinique, Little St. Vincent, and Balleseau, each of which produces a little cotton. The other productions of the island are, cinnamon, maize, sesamum, vanilla, Chinese tallow tree, camphor gum, and storax. The botanic garden, long under the management of Dr. Anderson, contains 30 acres, of which 16 are in the highest cultivation. In 1783, the island contained 61 sugar estates, 500 acres in coffee, 200 in cacao, 400 in cotton, 50 in indigo, and 580 in tobacco, besides what were occupied in raising plantains, maize, yams, &c. The following were the number of hogsheads of sugar of 13 cwts. received in different years.

1789,	6,400 hogs.	1805,	17,200 hogs.
1779,	12,120	1810,	18,000

And some years afterwards the quantity was 20,000.

St. Vincents contains an active volcano, called *Le Souffrier*, which is the highest mountain in the chain which runs through the island. It first discharged lavas in 1718; in 1811 about 200 earthquakes were felt, but in 1812 it desolated the island by a tremendous eruption, throwing out torrents of lava and clouds of ashes which nearly covered the island, and injured the soil to such a degree that it has scarcely yet recovered from it. This explosion was preceded, by 35 days, by the total ruin of the city of Carraccas, and violent oscillations of the ground were experienced both in the islands and on the coasts of *Terra Firma.* The ashes fell upon the decks of vessels above a hundred miles distant from the island. The crater of this volcano is a circular chasm, about 2000 feet up the south side of the mountain. It is about half a mile in diameter, and 450 feet deep. In the centre of the crater rose a conical hill, about 280 feet high, and about 200 in diameter, richly wooded with shrubs about half way up, the rest of it being powdered over with virgin sulphur to the summit. On the north and south sides of the base of the cone were two basins of water, one perfectly pure, and the other impregnated with alum and sulphur. The eruption began on the 27th April, but reached its paroxysm on the 30th. Torrents of lava rushed into the sea, and many houses were set on fire, and many negroes killed, by a stream of stones and fire, which lasted for an hour. The population of the island is 22,000, including 827 whites and 7406 free people of colour. West Lon. 61° 11′. North Lat. 13° 17′.

VINCI, Leonardo Da, a celebrated Italian painter, was the illegitimate son of Piero Da Vinci, a notary of the Signoria of Florence, and was born at the Castle of Vinci, in the Vale of Arno, in 1452. His love of drawing was early displayed, and he was placed under the tuition of Verochio, a sculptor and painter. In one of his early attempts, he painted an angel in a style so superior to that of his master, that Verochio ever afterwards confined himself to sculpture. He died on the 2d May 1519, at Cloux, near Amboise, in the 67th year of his age. His Treatise on Painting was translated into English by Mr. Rigaud in 1802, and a volume of his miscellaneous works has been lately published. For a full account of the life and works of this distinguished painter and philosopher, we must refer the reader to our article Painting, Vol. XV. p. 301–303. See also *Essai sur les ouvrages physico-Mathematiques de Leonard de Vinci*, par J. B. Venturi, Paris 1797, and Carlo Amoretti's *Memorie Storiche su la vita gli studi e le opere di Leonardo de Vinci*, Milano, 1804.

VINEGAR is the name of an acid liquor prepared from wine, cider, beer, and other liquors, and more recently from the distillation of wood. Whatever be the materials from which common vinegar is to be made, it is only necessary to admit air into the vessel in which it is to be kept, and to keep it at a temperature from 75° to 80° in this climate, in order to obtain vinegar. The different kinds of vinegar are four, *wine vinegar*, *malt vinegar*, *sugar vinegar*, and *wood vinegar.*

Wine vinegar is made in the following manner: the wine, when mixed with a quantity of wine lees, is transferred from the tun into cloth sacks, placed within a large iron-bound vat. The liquid is expressed from the sacks by pressure, and the fluid thus obtained is put into large casks with a hole in their top, and placed upright. In summer they are exposed to the sun, and in winter to a stove. In a few days fermentation takes place. If the heat now becomes too high, it must be lowered by coolers, and the addition of a little fresh wine, as the excellence of the vinegar depends on the fermenting temperature. The process is generally complete in a fortnight in summer, and a month in winter. The vinegar is then run off into barrels containing several chips of birch wood. In a fortnight more it will be found clear and fit for sale. It must now, however, be kept in close casks.

Vinegar is usually made from malt in this country. One boll of malt, masked in hot water, will yield 100 gallons of wort in less than two hours. When the temperature has fallen to 75°, four gallons of the barm of beer are added. At the end of 36 hours, it is transferred to casks, which are laid on their sides, and exposed, with their bung-holes loosely covered, to the sun or to stoves. In three months this vinegar is ready, when it is to be used for making sugar of lead; when it is wanted, however, for domestic use, the above liquor is put into upright casks, having a false cover perforated with holes, fixed about a foot from the bottom; on this cover is laid a considerable quantity of *rape*, or the refuse from the manufacturers of British wine, or for want of this, a quantity of low priced raisins. The liquid is turned into another barrel every 24 hours, in which time it has begun to grow warm. The vinegar is sometimes fully fermented without the rape, which is added towards the end of the process, to give flavour.

Sugar vinegar may be made from a weak solution of 18 ounces of sugar to every gallon of water. Yeast and rape are next to be added, and whenever the process is complete, as the taste and flavour will indicate, it is to be decanted into barrels or bottles. A momentary boiling before bottling, is favourable to its preservation.

Wood vinegar, or the pyroligneous acid, is obtained by subjecting wood to a strong red heat, in iron retorts. The best woods are oak, ash, birch, and beech. The liquor obtained is a crude vinegar contaminated with tar, the residuary charcoal being only one-fifth of the wood distilled. This crude acid is rectified by a second distillation in a copper still, by which 20 gallons (out of 100 of crude acid) of a viscid tarry matter are separated. It is now a transparent brown liquid, with an empyreumatic smell, and a specific gravity of 1.013. When redistilled, saturated with quick lime, evaporated to dryness, and greatly torrefied, the empyreumatic matter is dissipated, so that by decomposing the calcareous salt with sulphuric acid, a pure and perfectly colourless vinegar, agreeable to the taste, is obtained by distillation. See Dr. Ure's *Dictionary of Chemistry*, article Acid, *Acetic*. See also our article Chemistry, Vol. V. p. 696.

VINE, Vineyard, and Vinery. See our article Horticulture, Vol. X. p. 537, 569–574; 585, 586.

VIOLIN, an instrument of four strings, played by a bow, and tuned to fifths. The date of its invention is unknown. It has not been traced higher than the 16th century; and in the beginning of the 17th, it was hardly known in England. See Burney's *History of Music*, vol. i., and the Prize Essay of *Bagatella*, entitled, *Regole per la costruzione de' violini*. Padua, 1786.

VIRGIL, Publius Virgilius Maro, a celebrated Roman poet, and the author of the *Æneid*, was born B. C. 70, at Andes, a village near Mantua. He was educated at Cremona, Milan, and Naples, and was initiated into the epicurean philosophy by Syro. Upon the supposition, which is not improbable, that his own history is given in the Eclogues under that of Tityrus, he seems to have gone to Rome, when he was 30, to recover lands that had been possessed by the soldiers of Octavius and Antony. Here he was introduced to Octavius and to Mecænas, and through their influence he succeeded in recovering his property. When his Eclogues were finished, which was in his 32d or 34th year, he was induced by Mecænas to write the Georgics; and during the seven years which they occupied, he lived at Naples. The latter years of his life were spent in the composition of the Æneid.

Virgil was in great favour with Augustus; and when his beautiful tribute to the memory of Marcellus was recited before Octavia, the affectionate mother fainted away at the concluding words, *Et tŭ Marcellus eris*. In return for this pathetic celebration of the virtues of her son, she is said to have given the poet ten sesterces (above £.80) for every line of the passage.

Virgil paid a visit to Greece, where he met with Augustus at Athens. It was arranged that they should return together. He was seized, however, with an illness at Brundusium or Tarentum, which cut him off, B. C. 19, in the 52d year of his age. His body was conveyed, in pursuance of his request, and interred on the Puteolan Way.

The tomb of Virgil is still exhibited to travellers, and is thus described by Eustace: "To ascend the hill of Posilipo, we turned to the right, and followed a street winding as a staircase up the steep, and terminating at a garden gate. Having entered, we pursued a path through a vineyard, and descending a little, came to a small square building, flat roofed, placed on a sort of platform on the brow of a precipice on one side, and on the other sheltered by a superincumbent rock. An aged ilex, spreading from the sides of the rock, and bending over the edifice, covers the roof with its ever-verdant foliage. Numberless shrubs spring around, and interwoven with ivy, clothe the walls, and hang in festoons over the precipice. The edifice before us was an ancient tomb—the tomb of Virgil! We entered; a vaulted cell and two modern windows alone present themselves to view: the poet's name is the only ornament of the place. No sarcophagus, no urn, and even no inscription to feed the devotion of the classical pilgrim. The epitaph, which, though not genuine, is yet ancient, was inscribed by order of the Duke of Pescolangiano, the proprietor of the place, on a marble slab placed on the side of the rock opposite the entrance of the tomb, where it still remains. Every body is acquainted with it.

> "Mantua me genuit Calabri rapuere, tenet nunc
> Parthenope, cecini pascua, rura, duces."

Some authors have asserted that this is not the tomb of Virgil. The reader will find an ample discussion of the subject in Eustace's *Classical Tour through Italy*, p. 516—521. The general opinion is in favour of the authenticity of the tomb.

One of the best editions of Virgil is that of Professor Heyne, published at Leipsic in 1788. See the Article Æneid.

VIRGINIA.

VIRGINIA, one of the states of the United States, bounded on the S. by North Carolina; S.W. by Tennessee; W. by Kentucky; N.W. by the State of Ohio; N. by Pennsylvania and Maryland; N.E. by another section of Maryland, and E. by the Atlantic Ocean; having outlines:

	Miles.
Along N. Lat. 36° 30′, in common with North Carolina, - - - - - - -	340
Along Tennessee from its extreme north-eastern angle, to the extreme western angle of Virginia, at Cumberland Gap in Cumberland Mountain, - - - - - -	110
Along the main ridge of Cumberland Mountain in common with Kentucky, to the eastern and main branch of Sandy river, -	110
Down Sandy river by comparative courses to its influx into Ohio river, - - - -	70
Up Ohio river opposite to the state of Ohio, and following the bends to the western boundary of Pennsylvania, say - - -	400
Along the western boundary of Pennsylvania, due south, to the extreme south-western angle of that state, - - - - -	65
Thence due east along the southern boundary of Pennsylvania to the extreme north-western angle of Maryland, - - - -	60

Thence due south along the western boundary of Maryland,	40
Down the Potomac river opposite Maryland, to Chesapeake bay,	320
Thence over Chesapeake bay, Pocomoke bay, and over the intervening peninsula to the Atlantic Ocean,	55
Along the Atlantic Ocean,	110
Having an entire outline of	1680

These distances being measured from Tanner's Map of the United States by a scale, may not be minutely correct, but we trust are sufficiently accurate for all the ordinary purposes of geography. It may be necessary to note, that the short line over the peninsula between the Atlantic Ocean and Chesapeake bay, and between Accomac county of Virginia and Worcester county of Maryland, is usually drawn on maps along N. Lat. 38°; it is, however, actually farther north by about two minutes of latitude on the ocean, and declining to the southward, still strikes Pocomoke bay above N. Lat. 38°.

Again, the south-western boundary of Virginia on the state of Tennessee, ought, and is commonly supposed, to extend along N. Lat. 36° 30′, but by an error in the original survey this latter demarcation stretches two minutes or more, of latitude, to the north of the curve along which it was to have been extended.

In latitude, Virginia lies between 36° 30′, and 40° 37′ N., and in longitude, from 1° 46′ E., to 6° 36′ W. from W.C.

The longest straight line that can be drawn in Virginia, is in length 485 miles, and extends from the north-eastern angle on the Atlantic Ocean, to the extreme south-western on Tennessee and Kentucky. Measured carefully by the rhombs, the area of Virginia comes out about 70,000 square miles; therefore the mean breadth is 144 miles very nearly.

Nature has so palpably divided Virginia into two sections that her demarcations are obeyed in the legislation of the state, and in the taking of the decennial census by the general government. The following Tables exhibit the counties of each section, with their aggregate population, agreeably to the census of 1830.

TABLE I.

Eastern Virginia.

Counties.	Aggregate Pop. 1830.
Madison,	9,236
Greensville,	7,117
Prince William,	9,330
Nelson,	11,254
Matthews	7,664
Middlesex	4,122
Elizabeth City,	5,053
Charlotte	15,252
Southampton	16,074
Orange	14,637
*Dinwiddie, ex. of Petersburg	13,579
Chesterfield	18,637
Lunenburg	11,957
*Town of Petersburg	8,322
Stafford	9,362
Spottsylvania, ex. of Fredericksburg	11,826
Town of Fredericksburg	3,308
Total of Spottsylvania county	15,134
Northampton	8,641
Patrick	7,395
Henry	7,100
Nottaway	10,130
Brunswick	15,767
†Henrico, excl. of Richmond city	12,737
Fluvanna	8,221
†City of Richmond	16,060
Sussex	12,720
Prince George	8,367
King William	9,812
Prince Edward	14,107
Amelia	11,036
Surry	7,109
Northumberland	7,953
Fairfax	9,204
King and Queen	11,644
Pittsylvania	26,034
York	5,354
Louisa	16,151
King George	6,397
Richmond	6,055
Charles City	5,500
Bedford	20,246
Hanover	16,253
Princess Ann	9,102
Lancaster	4,801
Campbell	15,720
Town of Lynchburg	4,630
Total of Campbell county	20,350
Fauquier	26,086
Amherst	12,071
James City	3,838
New Kent	6,458
‡Norfolk Borough	9,814
Franklin	14,911
Westmoreland	8,396
Goochland	10,369
Cumberland	11,690
Isle of Wight	10,517
St. George Parish, Accomack,	9,109
Accomack Parish,	7,547
Total of Accomack county	16,656
Halifax	28,034

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* Dinwiddie county, including Petersburg	21,901
† Henrico county, including Richmond city	28,797
‡ Norfolk county, including Norfolk borough	24,806

Counties.	Aggregate Pop. 1830.
Loudon	21,939
Essex	10,521
Gloucester	10,608
Nansemond	11,784
Powhatan	8,517
Buckingham	18,351
Mecklenburg	20,477
Culpepper	24,027
Warwick	1,570
Caroline	17,760
Albemarle	22,618
*Norfolk county, exclusive of Norfolk borough	14,992
Total,	832,980

TABLE II.

General Aggregates of Eastern Virginia.

FREE WHITE PERSONS.

MALES	under five years of age	33,143
	of five and under ten	26,390
	of ten and under fifteen	22,527
	of fifteen and under twenty	19,801
	of twenty and under thirty	33,260
	of thirty and under forty	20,892
	of forty and under fifty	13,462
	of fifty and under sixty	8,786
	of sixty and under seventy	4,853
	of seventy and under eighty	1,928
	of eighty and under ninety	571
	of ninety and under one hundred	87
	of one hundred and upwards	13
		185,713
FEMALES	under five years of age	31,391
	of five and under ten	25,373
	of ten and under fifteen	22,361
	of fifteen and under twenty	22,438
	of twenty and under thirty	35,287
	of thirty and under forty	21,483
	of forty and under fifty	14,049
	of fifty and under sixty	9,303
	of sixty and under seventy	5,193
	of seventy and under eighty	2,295
	of eighty and under ninety	622
	of ninety and under one hundred	133
	of one hundred and upwards	14
		189,942
Total number of free white persons		375,655

White persons included in the foregoing who are deaf and dumb, under fourteen years of age	70
White persons included in the foregoing who are deaf and dumb, of fourteen and under twenty-five	64
White persons included in the foregoing who are deaf and dumb, of twenty-five and upwards	93
White persons included in the foregoing who are blind	215
White persons included in the foregoing who are Aliens. Foreigners not naturalised	363

TABLE III.

SLAVES.

MALES	under ten years of age	74,158
	of ten and under twenty-four	60,074
	of twenty-four and under thirty-six	38,403
	of thirty-six and under fifty-five	27,696
	of fifty-five and under one hundred	11,121
	of one hundred and upwards	125
		211,577
FEMALES	under ten years of age	73,666
	of ten and under twenty-four	58,574
	of twenty-four and under thirty-six	36,670
	of thirty-six and under fifty-five	24,483
	of fifty-five and under one hundred	11,219
	of one hundred and upwards	131
		204,743
Total number of slaves		416,320

FREE COLOURED PERSONS.

MALES	under ten years of age	7,118
	of ten and under twenty-four	5,240
	of twenty-four and under thirty-six	3,047
	of thirty-six and under fifty-five	2,302
	of fifty-five and under one hundred	1,472
	of one hundred and upwards	24
		19,203
FEMALES	under ten years of age	6,891
	of ten and under twenty-four	6,172
	of twenty-four and under thirty-six	3,960
	of thirty-six and under fifty-five	2,973
	of fifty-five and under one hundred	1,783
	of one hundred and upwards	23
		21,802
Total number of free coloured persons		41,005
Total aggregate		832,980

Slaves and coloured persons included in the foregoing who are deaf and dumb, under fourteen years of age	40
Slaves and coloured persons included in the foregoing who are deaf and dumb,	

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* Norfolk county, including Norfolk borough 24,806

of fourteen and under twenty-five	34
Slaves and coloured persons included in the foregoing who are deaf and dumb, of twenty-five and upwards	32
Slaves and coloured persons included in the foregoing who are blind	393

TABLE IV.

Aggregate of the counties of Virginia W. of the Blue Ridge, or as usually designated WESTERN VIRGINIA.

Augusta, North	9,143
Augusta, South	10,783
Total of Augusta county	19,926
Alleghany	2,816
Brooke	7,041
Bath	4,002
Berkley	10,518
Bottetourte	16,354
Cabell	5,884
Frederick, East	14,100
Frederick, West	11,946
Total of Frederick county	26,046
Greenbriar	9,006
Giles	5,274
Grayson	7,675
Harrison, East	10,133
Harrison, West	4,589
Total of Harrison county	14,722
Hampshire	11,279
Hardy	6,798
Jefferson	12,927
Kenhawa	9,326
Lewis	6,241
Logan	3,680
Lee	6,461
Monongalia, East	6,688
Monongalia, West	7,368
Total of Monongalia county	14,056
Monroe	7,798
Montgomery	12,306
Morgan	2,694
Mason	6,534
Nicholas	3,346
Ohio	15,584
Preston	5,144
Pendleton	6,271
Pocahontas	2,542
Randolph	5,000
Russell	6,714
Rockingham	20,683
Rockbridge	14,244
Scott	5,724
Shenandoah, East	8,327
Shenandoah, West	11,423
Total of Shenandoah county	19,750
Tyler	4,104
Tazewell	5,749
Washington	15,614
Wythe	12,163
Wood	6,429
	1,378,425

TABLE V.

Aggregate of Western Virginia.

FREE WHITE PERSONS.

MALES	under five years of age	32,650
	of five and under ten	25,415
	of ten and under fifteen	20,760
	of fifteen and under twenty	17,146
	of twenty and under thirty	27,651
	of thirty and under forty	15,647
	of forty and under fifty	9,919
	of fifty and under sixty	6,475
	of sixty and under seventy	4,118
	of seventy and under eighty	1,746
	of eighty and under ninety	537
	of ninety and under one hundred	97
	of one hundred and upwards	13
		162,174
FEMALES	under five years of age	31,020
	of five and under ten	24,591
	of ten and under fifteen	19,575
	of fifteen and under twenty	18,041
	of twenty and under thirty	26,757
	of thirty and under forty	14,973
	of forty and under fifty	9,701
	of fifty and under sixty	6,144
	of sixty and under seventy	3,572
	of seventy and under eighty	1,552
	of eighty and under ninety	476
	of ninety and under one hundred	55
	of one hundred and upwards	14
		156,471
Total number of free white persons		318,645

White persons included in the foregoing who are deaf and dumb, under fourteen years of age	62
White persons included in the foregoing who are deaf and dumb, of fourteen and under twenty-five	54
White persons included in the foregoing who are deaf and dumb, of twenty-five and upwards	76
White persons included in the foregoing who are blind	140
White persons included in the foregoing who are Aliens. Foreigners not naturalized	426

TABLE VI.

SLAVES.

MALES	under ten years of age	9,842
	of ten and under twenty-four	8,843
	of twenty-four and under thirty-six	4,786
	of thirty-six and under fifty-five	2,987
	of fifty-five and under one hundred	1,034
	of one hundred and upwards	8
		27,500

FEMALES	under ten years of age	9,541
	of ten and under twenty-four	8,347
	of twenty-four and under thirty-six	4,257
	of thirty-six and under fifty-five	2,723
	of fifty-five and under one hundred	1,056
	of one hundred and upwards	13
		25,937
Total number of slaves		53,437

FREE COLOURED PERSONS.

MALES	under ten years of age	1,118
	of ten and under twenty-four	886
	of twenty-four and under thirty-six	499
	of thirty-six and under fifty-five	419
	of fifty-five and under one hundred	259
	of one hundred and upwards	3
		3,184
FEMALES	under ten years of age	1,111
	of ten and under twenty-four	859
	of twenty-four and under thirty-six	541
	of thirty-six and under fifty-five	406
	of fifty-five and under one hundred	241
	of one hundred and upwards	1
		3,159
Total number of free coloured persons		6,343
Total aggregate		378,425

Slaves and coloured persons included in the foregoing who are deaf and dumb, under fourteen years of age	11
Slaves and coloured persons included in the foregoing who are deaf and dumb, of fourteen and under twenty-five	7
Slaves and coloured persons included in the foregoing who are deaf and dumb, of twenty-five and upwards	6
Slaves and coloured persons included in the foregoing who are blind	45

Measuring the respective counties by the scale from a map, and forming an aggregate area from the parts, does not yield a surface equal to 70,000 square miles, the surface given as that of Virginia in the first part of this article; but the discrepancy arises from fractional loss in each county. If, however, we take the reduced area of the counties as usually measured on maps, the difference may stand as an equivalent for the uninhabitable tracts occupied by the mountain chains.

Virginia is perhaps, of all the states of the United States, the one whose natural features are most contrasted. Similar to Maryland and North Carolina, Virginia is subdivided into three very distinct physical sections. First, the eastern, or sea sand alluvial section below the head of the Atlantic tides. Second, the middle or hilly section, from the head of tide-water to the distinct chains of the Appalachian system; and the third, the western or mountainous section. We might indeed divide the state into four physical sections, by making a western hilly section contiguous to the Ohio river, but the mountain chains are distinct so near the western border or Ohio river, as to justify including that region in the mountainous part.

These natural sections in their outlines and features, are so very distinct, as to be, as we have already remarked, recognised in the legislation of the state.

Comparatively there are few and only confined tracts of Virginia actually level. Such character of surface is restricted to the two counties of Northampton and Accomac, on the Eastern shore, and southward of the Chesapeake bay and James river, to the counties of Princess Anne, Norfolk and Nansemond, with an aggregate area of 2200 square miles, or less than the 31st part of the whole area of the state. Westward from Chesapeake bay, the country gradually rises into hill and dale, though some flat and even marshy land skirts the wide mouths of the rivers, which are discharged into either the Atlantic Ocean or Chesapeake bay. Virginia and Maryland occupy the central part of that physical section of the Atlantic slope of the United States, so remarkable for deep and wide rivers. Except, nevertheless, in extent, greater depth and relative position, Chesapeake bay differs in nothing essential from Pamlico and Albemarle Sounds to the south, and Delaware bay to the north. In Virginia and Maryland, the confluents of the Chesapeake seem to imitate that great recipient, and Pocomoke, Nantikoke, Choptank and Chester rivers on the east, and James, York, Rappahannoc, Potomac, Patuxent and Patapsco on the west, widen into expansive bays before their final discharge into their common recipient.

These minor bays become gradually more shallow, and more confined in width approaching the head of tide-water, but they all retain the distinctive character of bays, as far as the ocean tides penetrate inland. Below the head of the tides there are 36 counties, comprising an area of 9,989 square miles, or about two-thirteenths of Virginia. This section is that designated alluvial, but departing from the inner margin and proceeding towards the Atlantic, it is evident that the respective extremes were formed at very great difference in time. The primitive rock is only laid bare where traversed by the rivers, and in the intermediate spaces the hills very gradually merge into level planes towards the ocean.

The Blue Ridge traverses Virginia, 260 miles in a general direction from south-west to north-east, and except where traversed by Roanoke and James rivers, is a continuous ridge, and it is also in all its range in Virginia a county limit. Falling from this finely delineated chain, is an inclined plane, containing 15,386 square miles, terminated by the head of the Atlantic tides. This truly beautiful section, if we merely regard the fall of water, has a declivity from about 300 to 500 feet, but the descent of the rivers gives but a defective idea of the slope in the arable soil; which latter, towards the Blue Ridge, rises in many places to at least 1000 feet above the ocean level. The face of nature, though exhibiting little of grandeur, is rich and pleasing in the ever varying outline of hill, valley and river scenery. On the higher extreme, beside the elegant back ground of the Blue Ridge, other detached mountain chains rise, and give intimation that the solid structure of the country is Appalachian, and that the outer ridges or chains of that system influence the great bends of the rivers. This mountain influence is seen in the courses of Roanoke, James, Rappahannoc and Potomac rivers.

Between the head of tide-water and Blue Ridge are comprised 29 counties of Virginia, and 15,386 square miles. Taking the two eastern sections together, we have a surface of 27,190 square miles, comprising 65 counties, or not quite 420 square miles to the average of the counties. This combined extent is the region denominated Eastern Virginia, and the population of which by the census of 1830, is represented by Tables II. and III. On this part of Virginia the white population is within a small fraction of 14 to the square mile; the slaves and free coloured united, very near 17 to the square mile; and the aggregate of all classes, within a small fraction of 30 to the square mile.

The third or Great Valley section, is in many respects the most remarkable of the physical portions of Virginia. Lying between the Blue Ridge and the main Appalachian chains, and extending from the great bend of Potomac between Harper's Ferry and Hancock's town, about 300 miles to the northern border of Ashe county, North Carolina, and embracing 13,072 square miles, the mean breadth is 43 miles very nearly. This valley, as it is called, is a real mountain table land. By reference to Tables III. and IV., Article United States, page 240 of this volume, the reader will perceive that there is a difference of from 300 to 1400 feet between the relative elevation along the opposite sides of Blue Ridge. The tables referred to, expose also another remarkable phenomenon, that the Great Valley of Virginia rises from little more than 300 feet along the Potomac, to upwards of 2000 feet on the opposite extreme on North Carolina.

The surface of the Great Virginia Valley is in an especial manner broken and diversified, and in every part containing zones of highly productive soil. It is indeed the continuation of the Kittatinny valley of Pennsylvania and Maryland, and contains along the Blue Ridge a continuation of that immense limestone formation which, in fact, in an opposite direction, extends over New Jersey, New York and Connecticut into Massachusetts. The declivity of that part of this lengthened valley which is contained in Virginia, presents some peculiar features. The northern and nearly one half declines to the north-eastward towards the Potomac, and is there drained by the Shenandoah, Cacapon and South Branch of Potomac. Southward from the sources of Potomac and Shenandoah, is a middle slope drained eastwardly through the Blue Ridge by James and Roanoke rivers. The extreme southern part falls to the north-westward, and gives descent to New River, or the higher part of Great Kenhawa. We thus discover that this table land is partly on the Atlantic slope and partly on the Ohio Valley; and that the inflected line that separates the sources of James and Roanoke of the former, from those of Great Kenhawa of the latter river system, passes the mountain valley obliquely.

Politically the Great Valley of Virginia is subdivided into 17 counties, and containing 13,072 square miles; each county contains within a small fraction of 770 square miles. The aggregate population is 205,818, or a little above 15 to the square mile; but of these the whites comprise upwards of three-fourths.

Passing the table land, between Blue Ridge and Alleghany mountains, brings us on the Ohio section of Virginia. The extreme length of this western slope is within a small fraction of 300 miles, from the northern boundary of Tennessee, to the extreme northern angle of Brooke county; the greatest breadth 135 miles over the Kenhawa valley, but both extremes being narrow, the mean width is about 94 miles; area 28,337 square miles. The surface is in the far greater part mountainous or very hilly. The chains of the Appalachian system stretch over it very nearly parallel to the general course of Ohio river, in that part of that stream which bounds Virginia on the north-west side. The soil is as varied in quality as the surface is in feature, as every grade of fertility and of sterility may be found, the latter, however, greatly the prevailing character. The elevation of the water at the junction of the Ohio and Great Kenhawa being 533 feet above the ocean level, and that point being only about 40 miles above the extreme lowest point of Western Virginia at the mouth of the Great Sandy river, we may regard all the land surface of the Ohio section as rising above 500 feet. The relative oceanic elevation of Wheeling is 634 feet; therefore the Ohio river as a base to the great inclined plane, and as a recipient for the water of the western section of Virginia, forms in itself a deep valley, lying at a mean of upwards of 560 feet above the Atlantic Ocean, or on a level with Lake Erie, about mid-course along Virginia.

The dividing ridge between the sources of the Ohio confluents and those of the Atlantic Ocean, is the apex of the two opposing planes before us, having its highest elevation in the mountain valleys, from which rise on one side the sources of James and Roanoke rivers, and on the other those of Great Kenhawa. On the region from whence these rivers rise, the mean height of the farms exceeds 1600 feet. From these elevated valleys the Ohio sources flow like radii from a common centre. The different branches of Monongahela rise in Lewis and Randolph counties, and flowing northwardly over Harrison, Monongalia and Preston, and receiving numerous confluents, continue northward to meet those of Alleghany, and form the Ohio at Pittsburg.

From the opposite extreme flow the higher sources of Tennessee, whilst from the central part issue the fountains of Great Sandy, Great Kenhawa, Little Kenhawa and numerous creeks, all finding a common recipient in the Ohio.

From this rapid outline of the Ohio section of Virginia, it must be obvious, that the climate of the whole must vary materially from that of similar latitudes on the Atlantic coast; and again, from difference of relative level the climate on the high Appalachian valleys must be very different from that on the greatly lower and locally deep ravine of Ohio river.

The difference of temperature alluded to is so evidently great, that the writer of this article has seen repeatedly, early vegetation far advanced at Wheeling, when little or no appearance of spring met the eye along the dividing ridge of the waters.

All Virginia westward from Blue Ridge, comprising an area of 41,409 square miles, is the region of Virginia represented in the census tables by Nos. 4, 5 and 6. By reference to these tabular views it will be seen that the aggregate population, 1830, was 378,425, or a small fraction above 9 to the square mile. Of the preceding were whites, 318,645, or about 7½ to the square mile, whilst the coloured class, free and slaves, amounted to only 32,280, or about 8 per cent of the whole.

From the preceding elements we find the density of population in Virginia inverse to distance from the Atlantic, but we find also, that as the aggregate population becomes more scattered, that the relative number of whites increase, until on the large western section they amount to 92 per cent of the whole.

Political Geography, History, &c.—The first charter of Virginia was granted by Queen Elizabeth in 1583, and made out in favour of Sir Humphry Gilbert. This first English adventurer to form a colony in America, perished at sea in the attempt; but in the ensuing year, Sir Walter Raleigh, a maternal brother of Sir Humphry, obtained a renewal of the original patent. By both instruments the general name of Virginia was imposed on the Atlantic coast of North America. The term so very extensive as to embrace the whole extent from Florida indefinitely to the north, was gradually restricted to its existing limits.

Sir Walter Raleigh's patent was dated May 25th, 1584, and under it a colony was planted on Roanoke, which ultimately failed. In August 1587, the governor sailed to England in search of supplies, and the few persons left behind were never again heard of; they were, it is most probable, massacred by the savages. The patent was itself subsequently vacated by the attainder of Raleigh.

The war with Spain and the attempted invasion of England in 1588, and the declining age of Elizabeth, prevented such then merely speculative attempts during the residue of her reign, but early in that of James I., Mr. Hackluyt revived the intention of settlement on the North American coast, and himself and others obtained by petition, a patent dated April 10th, 1606, for that part of the coast extending from N. Lat. 34° to 45°. This great zone of 14 degrees of latitude, was granted to two companies under the relative names of North Virginia and South Virginia. South Virginia was given to the London Company, and North Virginia to the Plymouth Company.

The London Company effected a settlement April 1607, at Jamestown on Powhatan, or as since called James River, and thus commenced not only Virginia but the United States. So vague, however, and injudicious were the views of the London Company, that after four years of wretchedness and discord, the settlers broke up their establishment in 1610, and had actually embarked for Europe, but were restored to their abandoned houses by the timely arrival of Lord de la War.

In 1612 the second Charter was granted, and in 1619 the first legislature of Virginia was convened; and in 1620 Africans were brought into the colony by a Dutch ship and sold as slaves.

A state of natural distrust between the English colonists and the native Indians, was coeval with the settlement of Virginia, which, in 1622, eventuated in a massacre of the former by the latter, in which 347 persons perished. To the absurd and arbitrary government of the London Company was thus added Indian warfare. The vexatious measures of the Company were arrested in 1624 by interference of the crown. The colony was made royal and ruled by commission. The royal governors were little if any more wise or steady in their administration, than had been the agents of the London Company. To these petty tyrants there was one exception in Sir William Berkeley. This nobleman ruled with wisdom and moderation, and in 1729, restored the legislature of the colony by calling an assembly of the burgesses.

As an English colony, Virginia was royal in its features, and imparted congenial feelings to the inhabitants. In the long revolutionary struggle in England from 1642 to 1660, the Virginians sided with the royal party. Compelled by force to submit to parliamentary authority, they seized the first favourable moment to act upon their real sentiments, and Charles II. was acknowledged in Virginia before he was in England. The restoration of a pageant was alike a failure in both countries; but weak and defenceless the colony of Virginia suffered most, and the monopolising spirit of the mother country was felt in its effects upwards of a century,—to the revolution in 1775.

The Church of England was established by law in 1662, which, with exactions in trade, large grants of land to royal favourites, and the caprice of royal governors, excited and fostered a resistance which prepared the public mind to meet the catastrophe which produced the independence of the United States.

As early as 1732, the future hero of the United States was born in Virginia, and had become mature in years when his services were demanded to give the kings and people of the earth the most salutary lesson they have either ever received. In the colonial war, commenced in 1775, George Washington, and the Virginians generally were truly distinguished, and in consummating the revolution the part acted by that state was glorious in the true intent of the term.

Since the revolution, no great event particular to Virginia occurred until October 1829, when a convention met to revise the constitution.

The first constitution of Virginia was adopted the 5th July 1776, but the then existing settlements were in great part east of the Alleghany chain, and were even thin on the Great Valley contiguous to and west from Blue Ridge. As the population gradually extended to the Ohio, the provisions of the first constitution were regarded by the western settlers as partial and oppressive. After many abortive attempts, a convention met, and on the 14th of January 1830, reported the existing constitution, which was ratified by the people and is now in operation.

That most important of all rights, the right of suffrage is secured by very complex provisions. The right of voting is extended to every white male citizen of the commonwealth and resident therein, who has attained the age of 21 years and upwards, and who would have been entitled to vote under the former constitution: or if owner of a freehold of 25 dollars value; or if the holder of a joint interest in a freehold to the amount of 25 dollars; or who has a life estate in, or title in reversion to land of 50 dollars value, and had been in full possession of such an estate or reversionary title, six months before the election at which he offers to vote; or who shall own and be in the actual occupation of a leasehold estate, have put such title on record, two months before he shall offer to vote; original term at least five years, and rent value 200 dollars; or who has been a housekeeper and head of a family twelve months before offering to vote; and shall have paid a state tax within the preceding year.

The legislative power is vested in a Senate and House of Delegates, who together bear the style of "General Assembly of Virginia." The House of Delegates consists of 134 members, chosen annually and apportioned as follows. Thirty-six from tide-water district; 42 from that above tide-water and below Blue Ridge; 25 from the third or mountain district, and 31 from that of Ohio or the western district. Senate 32 members, 19 from the eastern and 13 from the western side of the Blue Ridge: the senators elected for four years, and one-fourth going out of office annually.

The apportionment of the relative numbers of the members of both houses to take place in 1841, and decennially afterwards, but the ultimate numbers of the senators limited to 36, and of the delegates to 150.

Executive power is vested in a governor, elected for four years by a joint vote of both houses of the legislature, and ineligible for the next three years after the expiration of his term of service. The second branch of the executive department consists of a council of state, elected by joint ballot of the two houses, and consisting of three members; term three years, and one member vacating his seat annually. The senior councillor is lieutenant governor.

The judiciary is composed of a supreme court of appeals and superior and inferior courts. Judges of the court of appeals and superior courts elected by the legislature in joint ballot. Term of office during good behaviour, or until removed by a concurrent vote of both houses of the legislature, two-thirds of the members present voting for his removal.

For staple productions and Internal Improvements, see article United States.

In making up this article we did not deem it within the scope of our duty to make any remarks on the respective colours or castes of its population, but as the legislature has itself acted upon the question of removal and abolition as regards its slaves and free people of colour, we place on record the following Preamble and Resolution, reported by a committee, and adopted by the house of delegates in January 1832, by a vote of 64 to 59.

Preamble. "Profoundly sensible of the great evils arising from the condition of the coloured population of this commonwealth; induced by humanity as well as policy, to an immediate effort for the removal in the first place, as well of those who are now free as of such as may hereafter become free; believing that this effort, while it is in just accordance with the sentiments of the community on the subject, will absorb all our present means; and that a further action for the removal of the slaves should await a more definite development of public opinion,

"*Resolved*, as the opinion of this committee, that it is inexpedient for the present, to make any legislative enactments for the abolition of slavery."

On the 28th of the same month, Mr. Broadnax from the Select Committee on Slaves and Free Negroes, reported a bill for the removal of free negroes, or such as may become free, and are willing to go to some place beyond the limits of the United States; this bill excludes coercion, except as to free negroes who remain in the state contrary to the law of 1806. The bill as amended, and finally passed by the House of Delegates, by a vote of 79 to 41, appropriates 35,000 dollars for 1832, and 90,000 for 1833, for the purposes above-mentioned —the place of removal left to the discretion of a central board, to consist of the Governor, Treasurer and Auditor ex officio, who have power to appoint agencies at Norfolk, Petersburg, and other places.

This bill, after passing the House of Delegates by so respectable a majority, has been indefinitely postponed in Senate, by a vote of 18 to 14; and thus the whole subject rests for the present.

VISION. See Optics, Vol. XIV. p. 749.

UIST. Under the name Uist, may be comprehended a large portion of that range of the Hebrides going under the appellation of the Long Island. It may be divided into North Uist, Benbecula, and South Uist, which, with their smaller islands, are all politically attached to Inverness-shire.

North Uist is a parish by itself. It is bounded on the N.N.E. by a sound of a mile broad, dividing it from the island of Berneray; on the E.S.E. by a channel denominated the Little Minch, dividing it from the Isle of Sky; on the S.S.W. by a strand overflowed by the sea at high water, which divides it from Benbecula; and on the W.N.W. by the Western ocean. It is about twenty miles in length from north to south, and from twelve to eighteen miles in breadth. Almost the only cultivated parts of the island are those on the west and north coasts, which are low and level for nearly a mile and a half inland. In favourable seasons, these parts yield luxuriant crops of bear. The soil nearest the sea is sandy, and between that and the moor is a thin black ground, covering either a hard gravel or solid rock, interspersed in some places with flats and meadows. In winter the grass entirely disappears, so that cattle are then fed, partly on straw, and partly on sea-weed. The rest of the country consists of a barren, soft, deep, moory soil, and hills of no great height covered with heath. The fresh water lakes are extremely numerous; many of them are large, and contain rocks and islands. So numerous are the shoals on the western coast, that it is inaccessible even to small boats, excepting in very fine weather. The east coast is bold and rocky, and much indented by inlets of the sea, many of them forming safe and commodious natural harbours. That farthest to the north is called Cheese Bay; it is of easy access from the S.E., and vessels may ride safely in it at all seasons of the year. Loch Maddie is a well known harbour, much frequented by ships trading to the Baltic. It extends five or six miles into the country, and is subdivided by the great number of islands it contains, into several smaller havens. Lochevort lies a few miles farther south, and is of the same extent, but, from its vicinity to Loch Maddie, it is less frequented. More to the south still are the harbours of Rueheva and Kellin.

A league to the northward of North Uist, lies Berneray, a fertile island of a mile and a half long. Within it lies Orinsay, an island only at high water; it is half a mile long, of a sandy soil, but fertile in good seasons. Three miles westward lies Vallay, likewise insulated at high water only, and, when the tide is out, separated from the shore by a sand two miles broad. It is a mile and a half long, not half a mile broad, and of a sandy soil, fertile in corn and grass in a good season, but very unproductive in bad years. Two leagues to the northward of North Uist lies Heisker, about two miles long, but very narrow. It is valuable for its kelp shores alone; yielding very little grass, and but a small quantity of corn. Kirkbost and Ileray stretch pretty closely along the west coast of North Uist, being separated from it, and from one another, by a sand overflowed at high water. The former is a mile long, very narrow, and of such a sandy nature, that it is literally in danger of being blown away by the wind. The latter is three miles long, and half a mile broad, and of a soil partly sandy, and partly black, and yielding tolerable crops of barley and pasture. Grimsay, also an island at high water, lies between North Uist and Benbecula; it is two miles long, and covered with heath, but is very valuable for its kelp shores.

Benbecula, lying to the south, is isolated from North Uist, only by a shallow sound, fordable at low water; it is divided from South Uist by a strait seven miles broad. This island is ten miles in circumference; its western coast is low, but its eastern side is hilly.

The island of South Uist is about twenty-seven miles in length from north to south, and from seven to nine broad. The channel called the Little Minch, on the east, separates it from Arissag and Ardnamurchan on the main land; and it is divided from Barra, lying to the south and west, by a sound eight or nine miles broad. The soil on the western coast is light, sandy, and almost rendered useless by the constant storms from the west; for although there are fine fields of natural grass here in summer, many of these spots are covered in winter by drifted sand, so that not a trace of verdure is to be seen for many months. Farther inland, there is one continued assemblage of swamps and lakes: still more to the eastward there are high mountains, covered with heath, but with verdure enough intermixed to pasture cattle, horses, sheep, and goats, during the summer and autumnal months. The natural harbours are on the east coast, and are called Loch Skiport, Loch Enort, and Loch Boisdale: they are well adapted for fishing stations. South Uist and Benbecula form one parish.

Kelp is the most important produce of Uist, the manufacture of which was totally unknown until the year 1735, when it was imperfectly introduced by one Rory M'Donald, who had been invited from Ireland to make experiments. Of this valuable commodity, more than 1200 tons were made per annum in North Uist alone. All the inhabitants, with the exception of the principal taxman, and a few tradesmen, were employed in the preparation of it from the 10th of June to the 10th of August. In South Uist not less, on an average, than 1100 tons were manufactured every year. Cattle constitute the next valuable production of Uist, of which about 750 head are annually exported. The total number of horses is probably about 2400, which is very large, considering the low state of agriculture; but they are of very diminutive size, and a great proportion of them are employed in the transportation of sea-weed for the manufacture of kelp; indeed, a good many horses are imported from Sky and Lewis. There are about 12,000 sheep in Uist, of a very small breed, covered with very fine wool, of which about 15 fleeces go to a stone. Goats are not numerous.

There has been no improvement upon agricultural implements for near a century. The plough in general use is little known beyond the Long Island. It is drawn by four small horses, has one handle, held in the right hand of the man who guides it, who at the same time uses a lash with his left hand. Another machine is drawn by one horse in front of this plough, having a crooked iron like a reaping hook attached to it, to cut the ground, so that the plough may turn it up with greater facility. The number of men and horses requisite to keep this plough going, makes it very expensive: for it requires one man to direct the plough, another to lead the horses, one to direct the iron for cutting the ground before the plough, and another to lead the horse harnessed to it. Some of the gentlemen farmers have discarded these rude machines, and have introduced the improved plough; but the most common mode of turning up the ground, is with an instrument called the cascroim or crooked spade. Harvest generally begins about September, and is completed about the end of October. They begin to manure the ground early in winter, continuing at this occupation until seed time. On the patches of arable ground set apart to them from year to year, they raise crops of barley, oats, and potatoes. In years of scarcity, the people live much on the dried roots of the *potentilla anserina*, growing in all the pastures in great plenty. The number of carts in Uist is very trifling; the common mode of transportation is on horses' backs.

From the constant employment of the people in kelp-making, and in cultivating with great toil the little spots of ground, the fisheries on the coasts, which might be rendered such a source of wealth to the inhabitants, are in a great measure abandoned to adventurers from other parts of the kingdom.

The population in North Uist may be widely estimated at about 4000, who are almost all protestants. In South Uist, there are about 5000 inhabitants, of which latter number about five-sixths are Roman Catholics. The people are in general sober, industrious, and acute, and so full of curiosity, as to be inquisitive to a degree bordering on impertinence, or at least having that appearance to strangers. They are for the most part honest and peaceable; all their little quarrels are determined before the baron bailie, with whose decisions they remain perfectly satisfied. Gaelic is the language generally spoken.

The climate of Uist is so variable, that it is not uncommon to have frost, snow, sleet, and deluges of rain, all in the course of a few hours: wet weather however predominates.

Little or nothing is as yet known of the mineralogy or botany of these islands. There are no trees, and even bushes will not rise higher than the wall which protects them. Game of all kinds abound, as well as all sorts of sea fowl; birds of prey are also numerous, particularly ravens (*corvus corax*), which at particular seasons come in such flocks, that they literally cover the country. The fresh water lakes are full of remarkably fine trout (*salmo fario*). The sea fish are herrings (*clupea harengus*), ling (*gadus molva*), cod (*gadus morhua*), mackerel (*scomber scomber*), turbot (*pleuronectes maximus*), skate (*raia batis*), and flounders (*pleuronectes flesus);* also great variety of shell fish. The basking shark (*squalus maximus*), is often killed on these coasts by the inhabitants, for the valuable oil produced by the liver.

Druidical circles are numerous all over Uist. Danish signal forts, built without cement, are very frequently met with: some of these are situated on rocks in the middle of the fresh water lakes, and are accessible from the shore by a causeway raised almost to a level with the water.

The island of Eriskay lies a little to the south of the extremity of South Uist; and a little to the S. and W. is Barray or Barra, (see that article,) with its attendant islands Flodday, Hellesay, Gigay, Watersay, Sanderay, Pabbay, Mengelay, and Berneray, all inhabited, and from one to three miles in extent. The productions of these islands are in every respect similar to those of Barra and Uist. See Macdonald's *Agricultural Survey* of the Hebribes, and Macculloch's *Description* of the Western Islands.

VITRIFIED FORTS. In our article FORTS, *Vitrified*, giving an account of these singular remains, we promised to state in this part of our work, whether any thing new had been discovered, throwing additional light on the subject equally interesting and obscure. We were surprised by what has been published by Dr. M'Culloch since our article appeared, because we could not have believed it possible, that any author could allow statements to go before the world which could be so very easily contradicted. A long time did not elapse when Sir G. S. Mackenzie, to whom Dr. M. very pointedly, though not very correctly alluded, published a letter to Sir Walter Scott on the subject, in which, ironically we presume, he endeavoured to prove that Dr. M. knew nothing of his theory. In this letter we find not only an exposure of Dr. M'Culloch's misrepresentations of what was stated in our former article, every word of which in regard to fact has been amply confirmed, but some additional information. Since our last article was written, we visited Barryhill in Strathmore. There are no vitrifications on the summit, only the remains of a rampart of loose stones, and of divisions within the area. But it is remarkable that vitrified stones, similar in all respects to those found elsewhere, are to be seen below. The stone of the hill is sandstone, of which the defences of the upper area are constructed, but the vitrified masses are primitive rock. The hill of Dunsinane, or Macbeth's Castle, in the same quarter, is a vitrified fort. It has been reported to us by a gentleman who visited Dun Sniochan, that Dr. M'Culloch's account of it is altogether incorrect. A great number of hill forts have been discovered, some with and some without vitrifications, on the Beauly, and the Glasswater in Inverness-shire, by Sir G. S. Mackenzie, as described in his letter above referred to. One in Ross-shire on the Ord hill of Kessock was subsequently discovered by Mr. George Anderson, secretary to the Northern Institution. This is defended by a mass of loose stones, not vitrified, while the melted masses are on the slope of the summit, where it is evident they could not have been intended as ramparts. Vitrified masses* have been recently found by Dr. John Home on the hill of Cowdenknows near Earlstoun. At the request of Sir G. S. Mackenzie, Mr. Fraser of Lovat directed the summit of the hill of Dun Lion to be examined by making a cut across it. Charcoal and burnt bones of ruminating animals were found in considerable quantities, but nothing else that seemed to throw any light on this curious subject. One additional argument against Lord Woodhouselee's theory is found in the fact of the ramparts of loose unvitrified stones, appearing at what we suppose to have been the entrance, or least defensible part. This, probably, would be the first to have been set fire to, had it been constructed of sand stone. Some further discoveries must be made before any thing approaching to freedom from objection can be offered. We must, therefore, still refer to the questions proposed at the conclusion of our former article. See *Letter to Sir Walter Scott, Bart., containing Observations on Vitrified Forts, &c.* by Sir G. S. Mackenzie; published by Waugh & Innes, Edinburgh, 1824; and the article FORTS, *Vitrified.*

VITRIOL. See CHEMISTRY, Vol. V.

VITRUVIUS, M. POLLIO, a celebrated writer on architecture, is supposed to have lived in the reigns of Julius Cæsar and Augustus. Formia is believed to have been his birth-place. His work on architecture was translated into English by Mr. Newton in 1791; but the most magnificent edition is that which was some years ago published by W. Wilkins, Jun., F.R.S. in two parts, royal folio.

ULSTER, county of New York, bounded S. by Orange; S.W. and W. by Sullivan; N.W. by Delaware county; N. by the Catsberg chain separating it from Greene; and E. by Hudson river separating it from Duchess. The outline is rather irregular, but the mean length from north to south is about 40 miles, whilst the mean breadth is near 30; the area 1200 square miles. Extending in Lat. from 41° 35′ to 42° 09′, and in Lon. from 2° 09′ to 3° E. from W.C. The general declivity of this very diversified country is from the west to east towards the Hudson valley. Except the adjacent county Greene, there is perpaps no other county in the United States which differs so much in relative height and variety of feature as Ulster. Though on the northern side, the boundary does not reach the high summits of the Catsbergs, still many parts of Ulster must rise to at least 1500 feet above tide water in Hudson.

The surface is every where most delightfully decorated with hill, dale and plain; but the most remarkable feature is the peculiar, and now united vallies of Walkill, Rondout, and Esopus creeks. The extreme source of Walkill is in Sussex county, New Jersey, from which it flows N.N.W. into Orange county, New York; and again sustaining the original course, enters, and traversing Ulster, falls into the Hudson river nearly opposite the town of Rhinebeck in Duchess county.

The Rondout, or northwestern branch of Walkill, rises in the eastern side of Sullivan and western of Ulster, unites with the Walkill in the latter. The Esopus creek rises in the northwestern angle of Ulster, and flowing first to the northwestward, directly towards the Walkill, until reaching within two or three miles of the junction of the latter with the Rondout. Thence the Esopus bends nearly at right angles, and assuming a northeastern course continues that direction to its entrance into the Hudson at Saugerties.

Though amid groups and chains of mountains, a continuous valley extends from the Delaware river along the valley of the Nevesink, and along the Rondout and Esopus to the Hudson. It is along this remarkable vale that now extends the Hudson and Delaware canal.

Advancing from the Delaware, this canal extends to the northeastward, entire length 64 miles; rising from the Delaware 80 feet, and falling from the summit level 535 feet to tide water in Hudson.

The course of the Hudson and Delaware canal in Ulster, demonstrates the peculiar structure of the country. Leaving the summit level, between the sources of some creeks of Nevesink, and those of Rondout, it thence follows the latter to near Mombacus. Here it is taken from the valley of Walkill into that of Esopus, and again along the latter to near Kingston, where it is returned into the valley of Walkill, and down the latter to its final junction with the Hudson at Eddyville.

The Hudson and Delaware canal may be regarded as continued in the Lackawaxen canal, and forming a navigable connexion between the Delaware and Hudson rivers, and into the rich coal district of Pennsylvania on the heads of Lackawaxen and Tunkhannoc rivers.

By the post list of 1831, there were 24 post offices in Ulster. These were at Kingston, the county seat, and at Accord, Brunswyck, Daslville Falls, Ellenville, Esopus, Lattintown, Libertyville, Malden, Marbletown, Marlborough, Milton, Modena, New Paltz, New Paltz Landing, Plattekill, Rosendale, Saugerties, Shandaken, Shawangunk, Tuthill, Ulsterville, Wawarsing and Woodstock.

Kingston, the seat of justice, stands on a plain between the Esopus and Walkill creeks, two miles westward from Rhinebeck ferry, by post road 93 miles very nearly due north from the city of New York, and 58 miles a very little west of south from Albany. N. Lat. 41° 55′, and Lon. 3° E. from W.C. Kingston, though adorned by many modern buildings, contains remains which attest the style of its founders the Dutch, and in the industrious habits of its existing residents, and the fine appearance of the adjacent well cultivated country, also appear the moral relics of those ancestors.

A cursory glance would naturally inspire very unfavourable impressions of the soil of Ulster, but its numerous towns, and the aspect of its orchards, meadows and fields, would correct the error.

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* These vitrifications which we have seen on this hill itself, are exactly similar to those obtained from the other vitrified forts in Scotland. ED.

In 1820, the population amounted to 30,934, or to nearly 26 to the square mile.

UNICORN, Sea. See Cetology, Vol. V. p. 567.

UNION, county of Pennsylvania, bounded by Mifflin S. and S.W.; by Centre W.; by White Deer Mountain separating it from Lycoming N.; and by Susquehannah river separating it from Northumberland E. The greatest length of this county is by a line nearly from S. to N. parallel to the general course of the Susquehannah river, 31 miles; mean breadth 22, and area 682 square miles. Extending in Lat. from 40° 39′ to 41° 05′, and in Lon. from 0° 08′ E. to 0° 22′ W. from W.C.

The mountain chains which traverse this county are humble when compared with those of some adjacent counties, and have but a slight inclination towards northeast and southwest, from extending east and west. The general declivity, shown by the course of the creeks, which flow over it into Susquehannah river, is to the east. The principal of these creeks, advancing from south to north, are Western Mahantango, Middle Creek, Penn's Creek, Buffalo and White Deer creeks.

The soil in quality and distribution, partakes of the character of that of other mountainous counties of Pennsylvania, and much in Union is excellent. In 1820, the population amounted to 18,619, and had increased to 20,749 in 1830, showing an augmentation of between 11 and 12 per cent. in the intermediate ten years.

In 1831, there were in this county post offices at New Berlin the seat of justice, and at Beavertown, Freeburg, Hartleton, Lewisburg, Mac Kees Half Falls, Middleburg, Mifflinburg, Mount Pleasant Mills, New Columbia, and Selin's Grove.

New Berlin, the seat of justice, stands on the north and left bank of Penn's Creek, by post road 168 miles almost due N. from W.C. and 60 a little W. of N. from Harrisburg. N. Lat. 40° 52′.

UNION, district of South Carolina, bounded by Newberry S.; by Ennoree river separating it from Laurens, S.W.; by Spartanburgh W. and N.W.; and by Broad river, separating it from York, N.E.; Chester E.; and Fairfield S.E. The greatest length of Union district is 40 miles from the extreme southern angle on Ennoree to the northern on Broad river. The greatest breadth is about 23, but the mean breadth about 16, and area, 640 square miles. Extending in Lat. from 34° 25′ to 35° 03′, and in Lon. from 4° 28′ to 4° 52′ W. from W.C.

The declivity of this district to something to the E. of S.E., and is traversed by Tyger and Pacolet rivers, and by numerous creeks, all having Broad river as a common recipent. The soil is generally good. Population 1820, 14,126.

By the post office list of 1831, there were offices at Unionville, the seat of justice, and at Brown's Creek, Cedar Grove, Cross Keys, Fishdam, Goshen Hill, Gowely's Store, Hancock, Jonesville, Mac Bridesville, Meansville, Oak Grove, Pinckneyville, and Reidstown.

Unionville, the seat of justice, is situated on a small branch of Fair Forest Creek, 30 miles a little E. of N.E. from Laurensville, and by post road 77 miles N.W. by W. from Columbia. N. Lat. 34° 42′, and Lon. 4° 38′ W. from W.C.

UNION, county of Ohio, bounded by Franklin S.E.; Madison S.; Champaign S.W.; Logan W.; Hardin N.W.; Marion N.E.; and Delaware E. Length from south to north 30, width 17, and area 510 square miles. Extending in Lat. from 40° 06′ to 40° 30′, and in Lon. 6° 14′ to 6° 34′ W. from W.C.

The slope of this county is southeastward, and drained in that direction by several creeks which are finally discharged into Sciota river.

There were in 1831, by the post office list, but two offices in this county besides that at Marysville the county seat; these were Darby Creek, and Milford Centre.

Marysville, the seat of justice, is situated on Mill Creek, by post road 37 miles N.W. from Columbus. N. Lat. 40° 15′, Lon. 6° 24′ W. from W.C.

UNION, county of Illinois, bounded N. by Jackson; N.E. by Franklin; E. by Johnson; S. by Alexander; and W. by Mississippi river separating it from Cape Girardeau county of Missouri. The two eastern angles of this county are right angles, and of course the northern and southern sides are parallel. The breadth is 18 miles, and the mean length from east to west being 22, the area is 396 square miles. Extending in Lat. from 37° 21′ to 37° 37′ N. and in Lon. from 12° 07′ to 12° 35′ W. from W.C.

Though having the Mississippi river for its western boundary, Union county of Illinois is a real table land, with the creeks issuing in every direction from its centre. Population 2362 in 1820.

By the post list of 1831, it contains but two post offices; one at Jonesboro', the county seat, and one at Mount Pleasant.

Jonesboro', the seat of justice, is situated on the central table land, about 35 miles a very little W. of N. from the junction of Ohio and Mississippi rivers, and by post road, 154 miles a little W. of S. from Vandalia.

UNION, county of Kentucky, bounded by Henderson N.E. and E.; by Tradewater river, separating it from Hopkins, S.E., and Livingston S.W.; and by Ohio river, separating it from Gallatin county of Illinois, W., and Posey county in Indiana, N. Length from south to north 42 miles, mean width 18, and area 756 square miles; extending in Lat. from 37° 23′ to 37° 52′ N., and in Lon. from 10° 44′ to 11° 15′ W. from W.C. Population in 1820, 3470.

In 1831, there were post offices in this county at Morganfield, the county seat, and at Bordley, Cypress, Mount Zion, Raleigh, and Sulphur Springs.

Morganfield, the seat of justice, is situated in a direct line about 12 miles S.E. from the junction of Ohio and Wabash rivers, by post road 205 miles, rather N. of S.W. by W. from Frankfort. North Lat. 37° 41′. Lon. 11° W. from W.C.

UNIONTOWN, post village, borough, and seat of justice, Fayette county, Pennsylvania, situated on both sides of Redstone creek, 12 miles S.E. from Brownsville, 45 miles S.S.E. from Pittsburgh, and by post road 193 miles N.W. by W. from W.C.; 184 miles a little S. of W. from Harrisburg, and 284 miles very nearly due W. from Philadelphia. North Lat. 39° 54′. Lon. 2° 45′ W. from W.C.

This borough was founded in 1775, by Jacob and Henry Beeson. It is ranged in great part in a single but compactly built street, along the United States road. The adjacent country is rolling, and very pleasant to the eye, and the western chain of the Appalachian mountains, rising at four miles distance, the landscape in that direction is picturesque and lengthened.

Uniontown, in the early part of its existence, increased rapidly towards that extent that could be supported from the adjacent country. This gives to the place at present a look of age which is not usual in the central towns of the United States. In 1820, the population was about 1200.

UNITED STATES.

United States, an extensive country of North America, having the Atlantic Ocean to the east, and the Pacific Ocean on the west, the British territories or Cabotia on the north, Russian America on the northwest, the Mexican provinces on the southwest, the Gulf of Mexico south, and the archipelago of the West Indies southeast.

Without pretending to absolute accuracy, the following outlines will show the great frontier lines.

	MILES.
In common with Cabotia, from the mouth of St. Croix river to the Rocky or Chippewayan mountains,	3000
With Russian North America, from the Chippewayan mountains to the Pacific Ocean,	600
Along Pacific Ocean, from the Russian limit, North Lat. 51°, to that of Mexico, North Lat. 42°,	560
In common with the republic of Mexico, from North Lat. 42° on the Pacific Ocean, along that curve of latitude to the Chippewayan mountains, and thence to the mouth of the Sabine into the Gulf of Mexico,	2300
Along the Gulf of Mexico to Florida Point,	1000
Along the Atlantic Ocean to the mouth of St. Croix,	1850
	9310

To determine the exact surface contained within this extended perimeter, would demand a very tedious and complex calculation, admitting every part of the outline to be fully defined, and the length exactly determined, but as the elements are far from being either adequately ample to decide the problem, we must adopt a proximate tabular result.

No. I.—*Table of the area contained within each zone of latitude of 1° in breadth, embraced by the territory of the United States, advancing from the northwest to south-east.*

Between Lat. N		Between Lon. from W.C.	Square statute Miles.
50° and	51°	37½° to 51° W.	41,391
49	50	35 50 W.	47,200
48	49	16 48 W. & 7½ to 9° E.	107,670
47	48	13 48 W. 7 to 9 E.	121,175
46	47	6½ 48 W. 6¾ to 9 E.	112,590
45	46	6 48 W. 5½ to 9½ E.	122,292
44	45	6 48 W. 1½ to 10 E.	138,240
43	44	5½ 48 W. 0¾ to 8 E.	140,640
42	43	5½ 48 W. 2 W. to 6 E.	130,487
41	42	6½ E. to 31 W.*	136,125
40	41	3 E. to 31 W.	125,324
39	40	3 E. to 30½ W.	125,343
38	39	2 E. to 28 W.	113,383
37	38	1 E. to 23 W.	92,328
36	37	1 E. to 23 W.	93,456
35	36	1 E. to 23 W.	94,740
34	35	0½ E. to 23 W.	93,861
33	34	3 W. to 23 W.	80,540
32	33	4 W. to 17 W.	53,154
31	32	4½ W. to 16½ W.	49,600
30	31	4½ W. to 16½ W.	50,134
29	30	4 to 7 W. & 12 to 17 W.	33,754
28	29	3¼ to 5¼ W.	6,394
27	28	3¾ to 5¼ W.	6,450
26	27	3 to 5½ W.	10,847
25	26	3 to 4½ W.	5,562
24	25	3½ to 6½ W.†	100
		Aggregate,	2,132,730

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* Thus far southwardly into the territory of the United States, the British territory indents the former, and interrups the continuity of the zones.

† This zone is chiefly in water, comprising the small islands and keys off Cape Florida.

It ought to be carefully remembered, that the data on which Table I. was constructed were used without reference to minute fractions. If, indeed, the entering and retiring angles were disregarded, and the outlines assumed as regular curves or straight lines, as the case might be, the actual area of the United States might be assumed at two millions of square miles; or, if taken comparatively, at the one-twentieth part of the habitable land area of the earth.

In the construction of this article, we shall first take a succinct view of the general structure and most prominent physical features; secondly, a view of the climate; thirdly, survey the political subdivisions; and fourthly and lastly, give a sketch of its history. In the latter section will be included the most prominent and important principles of the United States' constitution, and of those of the individual states.

Part I.—PHYSICAL GEOGRAPHY.

This article being a continuation, or more correctly a supplement to section United States, under the head of America, in the first volume of the Encyclopædia, the reader is referred to that part of the work for much matter necessary to a comprehensive view of the subject.

Taken in its utmost extent, as given in Table I., the territory of the United States extends, in latitude from Thompson's Island, 24° 30′ N. to 48° 2′ on the northern part of Maine, as laid down on Tanner's map; but to N. Lat. 51° on the Pacific ocean;* or perhaps more correctly, to Vancouver's Sound, Lat. 54°.

The most easterly point in the United States is on the eastern side of Manan Island, off Passamaquoddy Bay, 10° 20′ E. from W.C., and the most westerly point, if the latitude is extended to 54°, will be on the northwestern coast of Queen Charlotte's Island, 56° W. from W.C. These geographical limits give an extent of twenty-nine and a half degrees of latitude, and sixty-six and one-third degrees of longitude.

The longest line that can be drawn in the extensive regions included in the preceding outlines, and over land without intersecting any sea, would be from the Atlantic coast at Cape Connaveral, North Lat. 28° 20′, Lon. 3° 25′ W. to the northern end of Queen Charlotte's Island, say North Lat. 54°, Lon. 56° W. from W.C. This line would deflect from the meridians by an angle of 56° 28′, and measure a fraction above 3214 statute miles. Based upon this diagonal, the mean breadth is 664 very nearly. The whole territory is equal to an immense square of about 1460 miles each side.

Combined into one view, the United States' territory comprises four, or part of four vast inclined planes. These great planes are the descents from two systems of mountains, which, in relation to contiguous oceans, might have been very correctly called the Atlantic and Pacific systems. Rising from the Atlantic, and in the first part near that ocean, by a very moderate ascent, swells a plain, which gradually breaking into hills, finally terminates in a system of mountains. This system, designated by some writers "the Appalachian," but more generally "the Alleghany Mountains." To the latter name, there is an insuperable objection, as a generic term; that objection is, that the same term, Alleghany, is applied to one of the minor chains. Therefore, to avoid confusion of names, the eastern or Atlantic system of mountains will, in this treatise, be designated Appalachian.

If the structure of that part of North America between the deep gulfs of Mexico and those which compose Hudson's bay and Davis' straits was carefully and scientifically examined, it would be very probably found, that the Appalachian system of mountains is not confined to the United States, nor limited to the extent usually assigned to it on even our best maps. But, as correctly known, this system appears to rise in lateral chains, and to form the base of an immense continental protuberance, elongated from southwest to northeast, and maintaining a course in general accordance with that of the adjacent Atlantic coast. On the southwest, towards the gulf of Mexico, the Appalachian chains rise imperceptibly from the general level of the country; but it is a common and great error to suppose these mountains to be confounded with the hills. Though at the extremes, and particularly at that of the southwest, the Appalachian chains sink gradually; these chains are every where, if at all visible, utterly distinct from those remains of abrasion by water, called hills. If we suppose the whole Appalachian region to have once formed a gradual and regular protuberance, without any valley or hill, and then suppose this parabolic surface exposed to the action of water, hills and valleys must be the necessary production; but this, nor any ordinary known operation of nature, by the agency of water, will tend to form a mountain. The action of water may, and no doubt does, by wearing away and displacing the soil, expose mountain masses. This latter operation is yet in progress, as may be seen by a cursory survey; but the effect is very different from what would be requisite to form a mountain.

A long and careful examination of the rivers entirely round the Appalachian region, first suggested to the writer a suspicion that the mountains which compose the nucleus of this system were deeply laid in the earth, and that what is in common language called "the mountains," were only prominent ridges emerging from the surface. The Chippewayan region I have never had means to examine, but from analogy am inclined to the induction, that there also, if examined, the laws of structure would be found similar to those which regulated the Appalachian system. With these preliminary remarks, we proceed to a general physical view.

It has already been remarked, that the United

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* Fixing the northwestern limit on the Pacific Ocean at 51° N. is only following common usage. Consulting the convention of 1824, between the United States and Russia, 54° in Vancouver's Sound appears to be tacitly the boundary agreed upon by the parties. *Lyman's Diplomacy*, vol. ii. p. 307.

States comprised four vast inclined planes. Perhaps the natural structure would be more easily and more correctly comprehended by regarding this great physical region as comprising the two distinct mountain systems; the Appalachian on the east, and Chippewayan on the west, and then view the adjacent and dependent slopes or inclined planes as only parts of the mountain systems.

The Appalachian system, as defined on the general maps of the United States, is divided into two great sections by the tide vale of Hudson's river. This very remarkable natural water separation has induced many to consider the two mountain regions on each side, as distinct systems, but we shall soon see adequate element to demonstrate the connexion, although the Atlantic tides are rolled through the gaps which intervene. The Hudson forms, however, a demarcation altogether sufficient to warrant its adoption in classifying the natural features of the United States, and to justify separating, in our description, the Appalachian system into two sections, that of the southwest, and that of northeast.

The southwestern section rises very prominent from the Hudson valley, at two distant points. At the distance of very nearly one degree of latitude north from the outlet of the Hudson into the Atlantic ocean, and between N. Lat. 41° 20′, and 41° 30′ the tides are borne into the interior of the continent between enormous walls of native rock, rising to from 1200 to 1500 feet above the high water level. To the primitive mariners who discerned the Hudson, this passage, now appropriately called the Highlands, must have appeared on a distant view, as an impassable barrier, in place of an opening to the concealed regions beyond. But clearing this narrow, and deep vale, the distant ridges of mountains seem to lie scattered on the far distance, until advancing about one degree of latitude farther north, the masses again rise to between 3000 and 3500 feet. This very striking group now called the Catskill, or Catsberg chain, discharging the Delaware river to the southwest and the Schoharie river to the north, seem, when first viewed ascending the Hudson, as if the chains at their bases rose from the stream, though at the nearest ten miles distant. The oceanic level of the Hudson gives full elevation of view and raises the peaks of the Catsbergs to an imposing height. Amongst the objects brought before the voyager for the first time up the Hudson the mountains arrest far most attention. Those parts of the northeast section of the Appalachian system are seen distinctly, but on the edge of the horizon, whilst the Highlands and Catsbergs protrude their masses into the very presence of the observer.

If we assume the extreme of the southern side of the Highlands, and the northern of the Catsbergs, as the breadth, the Appalachian system contiguous to the channel of the Hudson is something about 90 miles wide. A line, however, parallel to the Hudson, cuts the system rather obliquely, but even when traversed at right angles from Highlands, the system is upwards of 80 miles wide.

From the Hudson valley the chains, in no place clearly defined, range nearly southwestward into the basin of the Delaware, but with diminished height. Before we advance farther with the general description, we may pause to remove, by stating a few facts, a very general error as respects the connexion of the rivers with the mountains of the United States.

It has been already shown, that the Appalachian chains are not the superlative of hills, though such is the received opinion on the subject. The mountains are considered as the dividing ridge of the waters. So far from this being the fact, the Mohawk branch of Hudson, the higher branches of Delaware, and Susquehannah river all rise to the westward of the Appalachian nucleus. It is, therefore, in a qualified sense that the mountain masses can be considered as the most elevated part of the physical section to which they belong. We shall have another and more appropriate occasion to notice this important feature of the geography of the United States, and now proceed to survey the mountain system under view.

Taking the extremes of the northwestern section of the Appalachian system, the course is between S.W. and S.W by W., but between these extremes there are very considerable inflections. For instance, leaving the Hudson basin, the chains incline to the westward, and still curving in that direction, traverse the Delaware basin and enter that of Susquehannah, ranging something W. of S.W. by W. A curve is again made in the opposite direction in passing over the latter, and when reaching the Potomac basin, the course of the chains is very little west of south. Passing over the northern side of the Potomac basin, the system once more deflects, and with the basins of the Potomac, Rappahannoc, York, James, Roanoke, Yadkin, and Santee, to the southeast, and the great confluents of Ohio, the Monongahela, Little Kenhawa, Great Kenhawa, Sandy, Licking, Kentucky, Cumberland, and Tennessee, on the northwest.

With the higher valley of Tennessee, the Appalachian chains undergo a noted change in their relative courses. From the Hudson basin to the higher Tennessee valley, the chains which compose the system deflect in a general conformity to each other, but with the latter physical section, the two most prominent chains, Blue Ridge on the southeast, and Cumberland mountains on the northwest, first diverge from, and thence incline upon each other, enclosing one of the most remarkable mountain vallies of the earth. This singular valley will be more particularly noticed in the sequel, but we may here observe, that with its southwestern extreme, the distinctive chains of the Appalachian system no longer appear, and the basins of Mobile, and Appalachicola, commence the declivity or slope of the Gulf of Mexico.

Considering the Mobile basin on the southwestward and the Hudson basin on the northeastward, as the limits of the southwestern section of the Appalachian system, the general course does not materially differ from N.E. and S.W., nor does the length vary essentially from 900 miles. The relative bearing and length are easy to determine, however, when compared with the breadth of the system. An attentive observer, comparing the objects in nature with any of our maps, must very soon perceive, that the chains of the Appalachian system, southwest from the Hudson, are too much restricted on both sides. Again, comparing the courses of the rivers with the ranges of the mountains, will enforce the conviction that the mountain structure prevails and exerts influence over the water channels far from the extreme chains marked on our maps. With these remarks we proceed to examine the chains specifically, premising that as no connected and scientific survey of this mountain system, much of what will be given under the section of chains may be regarded as theory to stimulate to future inquiry.

It may seem, indeed, the excess of hypothesis to consider the falls of the rivers as the outer chain of the Appalachian system, but if we trace a line from the perpendicular rocks on the Hudson, through the lower falls of Passaic, Raritan, Delaware, Schuylkill, Christiana, Susquehannah, Gunpowder, Patapsco, Patuxent, Potomac, Rappahannoc, Mattapony, Pamunky, James, Appamattox, Nottaway, Mehexin, Roanoke, &c., and continue a similar demarcation to the Mississippi, and then compare its inflections with those of the Blue Ridge, the correspondence will appear in a remarkable manner striking. The series of falls in the Atlantic rivers, southwest from the Hudson outlet, is in no place passed by the ocean tide, but these cataracts do not, however, regularly bound the tides, as they are not in every river channel reached by the ocean swell. A remark on the great defect of our maps is here irresistible. On the very expensive maps of Pennsylvania, Virginia, North Carolina, and South Carolina, the limit of ocean tides is alike wanting, and what renders the omission the more to be regretted, is the great importance of such data, in the commercial and physical history of the Atlantic rivers. In fact, the still more obvious if not equally important feature, the river falls are also omitted, but the points are in most instances marked by the rise of cities, and very prominent landmarks are determined by the cities or towns of New York, Paterson, New Brunswick, Trenton, Philadelphia, Wilmington, Baltimore, Georgetown, Fredericksburg, Richmond, Petersburg, Weldon, Fayetteville, Columbia, Milledgeville, and others of lesser note. By drawing a marked line through these points on a map, a great physical limit is obtained, separating the sea-sand alluvial region from the hilly, or more correctly, the mountainous interior. The most careful view of external nature, cannot in every place trace the line of separation, but if that line is crossed at right angles, or nearly parallel to the general course of the rivers, the features of the country so completely change as to demonstrate the essential distinction between the components of formation above and below the river falls.

The sea-sand alluvial region has a very prominent termination on the northeast, at the mouth of the Hudson, or more correctly at that of the Raritan. The Nevesink hills are detached and belong strictly to the chain which forms Long Island, the inner verge of the sea-sand alluvion meets the primitive rock in a line very nearly coinciding with southwest and northeast, from the lower falls of Raritan to the lower falls of Delaware, leaving the peninsula now forming the southern and rather larger section of New Jersey on the sea-sand physical tract. Here occurs a phenomenon, nowhere else to be found on the Atlantic slope of North America. That is the rise of a stream on the sea-sand tract, with its course towards and over the primitive; this very remarkable case is afforded by Millstone river; which, rising on the sea-sand alluvion, flows directly from the opposite Atlantic coast, and towards the Appalachian chains, crosses the primitive ledge, and unites with the Raritan about ten miles above the head of tide water. The Millstone, it may, however, be premised, is one of a series of small rivers and creeks which flow northwestward by west, having the Raritan and Delaware as recipients; but, as has already been noticed, the Millstone is the only stream which has its source on the alluvion, and final discharge within the outer margin of the primitive.

The series of water courses, which commence, advancing from north to south, with the lower confluents of the Raritan, and which flow inland, is not terminated by Delaware Bay, but is continued on the Chesapeake and Delaware peninsula to its extreme southern point, Cape Charles. The Manalapan and Millstone flowing into Raritan, and the Assanpink, Rancocus, Pensauken, Coopers, Oldmans, Salem, and other creeks entering the Delaware, are followed beyond that estuary by the Elk, Sassafras, Chester, Choptank, Nantikoke, Pocomoke, and numerous smaller streams which, rising on the sea-sand alluvion, find their discharge in Chesapeake Bay.

In the physical features of the small rivers originating on the sea-sand alluvion, and which have the Delaware bay as a common recipient, and those of similar origin on the Chesapeake and Delaware peninsula, there are two marked distinctions. The northwestern slope of the New Jersey peninsula does not exceed a mean breadth of 15 miles, and the Millstone and Rancocus, the longest of the streams it produces, both fall short of thirty miles direct course; the direction of these numerous but short water courses almost invariably between N.W., and N.W. by W. directly at right angles to the great opposing primitive ledge. But passing the Delaware bay, and traversing the Chesapeake and Delaware peninsula, we discover the rivers have changed their courses, and now flow south of S.W., parallel to the Appalachian chains.

A critical survey of the Atlantic slope of the United States, superinduces the induction, that Long Island Sound, Delaware bay, and Chesapeake bay, are specifically similar to Albemarle, and Pamtico Sounds; and, that Long Island, the peninsula between Delaware river and the Atlantic Ocean; that again, between Delaware bay, the Atlantic Ocean, and Chesapeake bay, the low capes outside of Albemarle and Pamtico sounds, and finally, the peninsula of Florida, were all protuberances of specifically similar nature.

Long Island is separated from the continent by a sound, through which the water yet passes to considerable depth, and when compared, there are strong reasons to conclude that such was once the case with the Delaware and Raritan; with the Delaware and Chesapeake, and with the Chesapeake and Albemarle Sound. Beyond Long Island, a similar theory will apply to Cape Cod, and, exterior to the limits of the United States, to the peninsula of Nova Scotia.

Calling in the aid of comparative geography, to illustrate the particular features of the United States, and seeking another part of the earth most similar in respect to position relatively, our attention is arrested by southeastern Asia. By actual calculation, the coast of North America from Cape Tehuantepec, crossing the intermediate land, and thence along the coast of the United States, deflects from the meridian 47° 44′, whilst the entire south-eastern coast of Asia is within an inconsiderable fraction of N.E. and S.W.; the two coasts only differing in direction $2\frac{3}{4}$°. To the remark, how very nearly parallel are these two coasts at a distance of under 6880 statute miles, we may add that in relation to the respective continents, and to the general course of atmospheric currents, the North American and Asiatic coasts, they are the two objects of such immense extent on earth which coincide in so many points of resemblance. The islands and gulfs of south-eastern Asia are more like the contiguous continent, on a wider scale, than are the corresponding features of the United States Atlantic coast. The application of the resemblance here adverted to, will be seen under the head of climate; we now return to our particular subject.

The sea-sand alluvial region, falling, as we have shown, from the primitive ledge over which the rivers are precipitated, is narrow and interrupted by the ocean reaching the primitive to the north-eastward from the Hudson; but thence rapidly widening to the southwestward, is traversed by the Delaware, Chesapeake, and lesser bays, and though penetrated by the tides to the margin of the primitive, the ocean and interior mountains seem to recede from each other, leaving between the Chesapeake and Gulf of Mexico an immense plain of above 600 miles in length, and upwards of 100 miles mean breadth.

The remains of shell banks along the inner margin of this great, and but very slightly inclined plain, fully establish the fact, that over its whole surface the ocean once rolled, and by a slow recession left most of the surface dry land. The bays and sounds are, however, remains of the former shallow ocean border. We are naturally, or more correctly by custom, led to estimate the depth of water on coasts, relative to the draught of ships, and to designate bays, gulfs and river mouths and channels deep, if that depth exceeds the utmost in which the largest vessels float, but philosophically speaking, a depth of even 40 or 50 feet is really shallow when compared with that of any large sea, much less an ocean. But, on the scale we usually estimate water depth, the rivers and sounds of the United States, contained in the great alluvial physical section south-west from the Chesapeake, are shallow, one river only, the St. Mary's, admitting the entrance of the largest vessels; and in many instances of apparently spacious harbours, the smallest coasters are navigated with difficulty. If the Atlantic Ocean is still receding, the result, in a series of ages, must produce radical changes, and many expensive experiments have been made to determine a much less important problem. When in Europe the abasement of the Baltic Sea was first suggested, the fact was rejected with something like horror, but the only safe test of truth finally put the contest at rest, and compelled the adoption of the result with all its consequences. This very interesting part of geographical history will be again touched under the head of river basins; we now return to our review of the great and general outlines of the physical sections.

Receding westward from the Atlantic Ocean along the zone, between the 30th and 31st degrees of north latitude, the alluvial plain is perpetuated over the peninsula of Florida, and thence westward along the northern coast of the gulf of Mexico, through $7\frac{1}{2}$ degrees of longitude, or about 450 statute miles to the estuary of Pascagoula river. Here the vast Delta of the Mississippi protrudes the alluvion to the 29th degree of North Lat., gradually, however, again receding to the northward, between 29° and 30° North Lat. passes the Sabine, stretching beyond the limits of the United States.

There is one feature of the alluvial zone north of the Gulf of Mexico, which demands particular notice, as it is connected with a phenomenon very little known. Between Vacassansa Bay of the western coast of the Gulf of Mexico and the mouth of the Mississippi river, extends an elliptical bay, the longer axis of which is North Lat. 29°. This bay curves to North Lat. 30° 23′, between the mouths of the rivers Appalachicola and Pascagoula, and along this part of the coast of the Gulf of Mexico the alluvial plain is narrow, and confined, indeed, to the small counter-bays of St. Joseph's, St. Andrew's, Choctaw, Pensacola, Mobile, and Pascagoula. To the westward from the outlet of Pascagoula, the coast entirely changes character. The Delta of the Mississippi is protruded upwards of eighty minutes of latitude directly into the Gulf of Mexico; and again, to the westward of the Delta to the Sabine, the alluvial zone is spread, as already noticed, about one degree of latitude south of its extent in that direction, east of the Delta.

The writer of this article personally examined the coast of Louisiana and Florida, and, in the progress of that survey, found that the *debris*, or wood floated out of the Mississippi river, was invariably borne westward from the outlets of that stream. These fragments of timber, or not unfrequently whole trees of vast size, lie scattered along the gulf margin, and afford the only fuel on that dreary coast. The northern shore of the great bay between the Delta and West Florida is covered with a dense forest. This forest is continued on very nearly the same geographical zone to the Sabine, whilst on, and directly westward of the Delta, the much most extensive part of the land surface is denuded of timber, presenting an immense series of grassy plains, with partial clumps or very thin selvedges of trees along the streams.

It may be placed amongst the most remarkable facts in the hydrography of the earth, that a canal or series of canals, and bay or sound navigation, could be constructed from the mouth of Hudson river to that of Sabine, with a rise of very little, if any, above 200 feet, and seldom more than from 10 to 20 feet; a series which, if formed, would constitute the most important and productive chain of inland navigation which the surface of our planet admits.

Over the long and wide alluvial plain we have glanced upon, flow the numerous rivers having their origin on the Appalachian nucleus in its rear. Those rivers we now proceed to notice, advancing from north-east to south-west; giving the name of the basin to the main stream, which terminates in the oceanic recipient.

Hudson river, as connecting two physical sections, comes appropriately under either head, but when carefully examined on a map, in connexion with the minor basins of Passaic and Raritan, the basins of Hudson and Delaware are more intimately blended than is the former with the contiguous basins of St. Lawrence, Connecticut, and Housatonick. Taken in its utmost extent, the Hudson basin presents a marked anomaly amongst the Atlantic rivers. By the main channel, the ocean tides traverse the primitive chains, and reach the base of the central secondary. The Hudson is formed by two branches; the northern, or Hudson proper, and the western, or Mohawk.

The Hudson has its remote source interlocking with those of the Racket river branch of St. Lawrence, and with those of the Saranac and Sable rivers flowing into Lake Champlain, at about N.Lat. 44°, Lon. 3° E. from W.C. Flowing south southeastward until only separated by a narrow ridge of five miles from Lake George, the Hudson deflects to the south, and at about 50 miles comparative course from the source, receives the Sacondago river from the west. Both those streams rise in the valleys of a ridge or rather chain of mountains, the continuation of the Catsbergs, as we shall see in the sequel. Below their junction the course of the united waters is to the eastward 12 miles direct, but a much greater distance following the channel, to where it is precipitated down a mountain ledge called Glenn Falls, and enters the very peculiar valley formed by Hudson river, Lake Champlain, and Sorel or Richelieu river. There is only one other known valley of the earth having specifically similar features with that we are reviewing. Scotland is divided into two unequal parts by a vale, extending from the Atlantic Ocean on the northwest side of the island, in a direct course nearly N.E. into Murray Frith or bay, of the German Sea, length 120 miles. This valley is well designated by the term glen, signifiying a confined vale between steep and impending hills or mountains. The Caledonian Canal now unites the small rivers and lochs or lakes of the Scottish Glen, and admits the navigation of frigates across the island of Britain. Naturally, the highest intermediate summit between the Atlantic Ocean and German Sea was only about 70 feet in this interesting valley.

The North American Glen, on a much larger scale than that of Scotland, has the southern extreme in the outlet of the Hudson into the Atlantic Ocean, between Staten and Long Islands, and its northern termination in the St. Lawrence, at the mouth of Richelieu, or, as called in the lower part of its course, Chambly river. The tide part of the Hudson, about 160 miles in length, though usually denominated a river, is really a bay, in the strict meaning of the latter term. This bay is merely long and narrow, and in those circumstances only does it differ from other bays. Rivers and bays differ materially in the opposing curves of their sides respectively. Rivers have opposing sides, with usually very nearly coinciding curves; on the contrary, bays have entering and retiring curves, with no apparent compliance in their inflections. Under the preceding distinction, the Hudson, below the junction of Mohawk and Hudson proper, is a bay.

Immediately below Glenn's Falls, the Hudson, as stated above, enters the Great Vale, and abruptly turns to the southward, and, continuing that course 35 miles, unites with the Mohawk a very little above the head of the tides. The intermediate distance of 20 miles from the great bend of Hudson, below Glenn's Falls, to the head of Lake Champlain, at the mouth of Paulet river, contains the highest summit level, 140 feet oceanic elevation between the tides of St. Lawrence and Hudson. The mind of the voyager on Lake Champlain, in view of massy mountain scenery, can scarcely admit the proof afforded by mathematical admeasurement to convince him that the fine sheet of water on which he is sailing is really only 87½ feet above the level of the Atlantic Ocean, and that so small a comparative descent would bring him to the tide level in St. Lawrence.

The whole length of the Great Glen of North America is within a trifling fraction of 375 miles in length, extending from north latitude 40° 34′ to 46° 2′, and differing so little from the meridian as not to deflect one degree of longitude in 328 minutes of latitude. But what in a very striking manner gives interest to both the American and Scottish glens, is the little deviation of either from a straight line between the extremes. The Hudson bay and river, Lake Champlain and Richelieu river, forming the chain of the American Glen, as do Loch Linnhe, Loch Eil, Loch Lochi, Loch Oich, Loch Ness, and Murray Frith, that of Scotland.—But to return to our survey.

The fall in the Hudson waters, from Glenn's Falls to tide water, is 104 feet, which has been overcome by locks on the Hudson and Champlain Canal.

Mohawk river, or the northwestern constituent of the Hudson, has its remote sources interlocking with those of Black river and Oswego, flowing into Lake Ontario, and those of the Chenango branch of Susquehannah. The Mohawk valley lies very nearly at right angles to that of Hudson, and presenting the second lowest gorge in the Appalachian system between the Atlantic Ocean and Canadian inland sea. The higher sources of Mohawk flow, by a very rapid descent, to the southward about 20 miles, to an alluvial summit level of only 421 feet above tide water in Hudson Bay; the Mohawk summit level being 281 feet higher that of the Hudson and Champlain.

In a state of nature, previous to the construction of the great western canal, in seasons of high floods, the waters were so nearly poised on the level near where Rome now stands, that part of the flow passed into Lake Oneida, by Wood creek, and thence into Lake Ontario, by Oswego river. The discovery of this remarkable feature in the topography of the table land between the Mohawk and Oneida valleys was one of the incidents which led, and naturally lead, to the original design of the Hudson and Erie canals; and the existence of such a depression in the table land between the tide, deep, and narrow valley or bay of Hudson and the middle part of the St. Lawrence basin, afforded an opening to inland navigation very rarely found in the mountain systems of the earth. It may also be remarked, that this plateau or table land is alluvial, and that in the construction of the Hudson and Erie canal, the most extensive masses of rock encountered were found below the summit level; and that feature in the local line of the great canal of New York leads on to the remark, that the mountain chains which compose that section of the Appalachian system, southwest from the Hudson, do not ever generally, much less uniformly, constitute the dividing ridges between the sources of the rivers of the Atlantic slope and those which flow into the Mississippi basin. This relative structure of our mountains, and the courses of our rivers, so contrary to common opinion, demands and deserves particular notice and description, since without understanding this perhaps peculiar structure, no adequate idea can be obtained of the true configuration of the United States.

Departing from the Hudson Bay, and without regarding the mountain chains or ridges, the table land rises slowly, and between the sources of Susquehannah and those of the confluents of Lake Ontario, one or more valleys exist where the summit level between the Atlantic tides, in Chesapeake Bay, and the surface of Lake Ontario falls under nine hundred feet, but passing the basin of Susquehannah, the mountain table land rises more rapidly, and also more uniformly. With some but partial interruptions, the rivers flow, and the mountains lie on a vast inclined plain from the valley of the west branch of Susquehannah southwestwardly, to where the sources of the Yadkin, Kenhawa, and Watauga branch of Tennessee separate. From the latter point, occupied by Ashe county, North Carolina, the great plain declines in the contrary direction, and if the distance is continued to tide water in Alabama and Tombigbee rivers, the length of descent in the two plains is very nearly equal.

If we draw a line on a good map along the dividing ridge between the sources of the rivers, we shall by the operation discover the fact, that the mountains in no one instance determine the recipient; but, on the contrary, the rivers in most cases rise on plains higher than the bases of the chains, and so far from flowing from, they are discharged through the mountains. The Mohawk, though a confluent of the Atlantic, has nearly the whole of its course to the interior of the Appalachian system. The west branch, and most of the minor confluents of the east branch of Susquehannah rise also within the Appalachian chains. The Potomac rises westward of the central chain, and a similar remark applies to James and Roanoke rivers. Passing the basin of James river, we discover the reverse, as, in a distance of 250 miles from the extreme sources of Roanoke to those of Savannah and Chattahooche rivers, the confluents of Ohio have their most remote sources in Blue Ridge. The entire force of these remarks will be more distinctly seen under the respective heads of the rivers; but we may remark in this place, that the relative aspect of the rivers and mountains of the United States, almost enforces the theory, that the latter were formed subsequently, and have been broken at various points by the streams, to the courses of which these great masses of rock formed impediments. By tracing the real line of separation between the confluents of the two great recipients, the reader will be enabled to more distinctly review the individual basins.

Commencing this river line at the summit level between the valleys of the Mohawk and Oneida, it curves first S.W. and thence W. and N.W. by an elliptic indenting into the basin of Susquehannah, and out of which flow the higher sources of Onondago or Oswego river. This curve, forming the extreme northern boundary of the basin of Susquehannah, is about 120 miles in length, and affords another and striking instance of the conformity of the line we are surveying, with the curves of the adjacent recipient, as the curve which separates the basin of Susquehannah from the Valley of Onondago, complies in its general inflections with the south-eastern shores of Lake Ontario.

Sweeping round the sources of the Tioga branch of Susquehannah, which it separates from those of Genessee, the latter a confluent of Lake Ontario, the river line now inflects to a general southern course 65 miles, to that elevated table land from whence flow northwardly the higher sources of Genessee; north-westward the extreme source of Alleghany, and semicircling round from east to south, and on to west, the numerous fountains of Cowanesque, Pine Creek, Sinnamahoning, and other confluents of Susquehannah. From this plateau the water-courses flow in every direction, like radii, from a common centre. From it, the nearest tide water is the mouth of Susquehannah, at a direct distance of 185 miles; but the head of tides round from Albany in the Hudson, including the entire course of the Hudson, the head of tides in Delaware, Schuylkill, and Potomac, all fall within 210 miles, and of course within 25 miles of being equi-distant from that great crown which stands at the extreme north-eastern source of the immense basin of the Mississippi and the north-western source of the less extensive, but very interesting basin of Chesapeake. It is also distant 90 miles from the mouth of Cataraugus river into Lake Erie, and 110 from Lake Ontario, at the mouth of Genessee river. The plateau before us is not, however, a mathematical point: its length from the source of Pine creek to that of Clarion river, a branch of Alleghany, is 35 miles, in a direction from east to west, nearly.

From the sources of Pine creek and Clarion river, for a distance of 70 miles, the dividing ridge of the rivers is, for the first instance from the Mohawk valley, a chain of the Appalachian system, but what renders that chain singularly remarkable, as connected with the rivers, is, that it is the most northwestern, and most humble in height, of all the chains of the system to which it appertains. Thus whilst the base of the Chesnut Ridge is the most elevated, a circumstance demonstrated by the course of the streams, the chains rise in elevation, descending the river valley towards the Atlantic tides; and so far is the source of the rivers at this place from being regulated by the mountains, that the entire course of Susquehannah is across, and not from, the Appalachian system. If we regard the head of the tides as the real mouth of the Susquehannah, the whole of that stream and its minor branches flow down an inclined plain 200 miles wide, and commensurate with the breadth of the Appalachian system.

Inflecting again to the south-east, the river line recrosses the intermediate valley, and extends south-eastwardly from Laurel Hill to the Alleghany Mountain. The latter chain becomes a real and unbroken dividing ridge of river source 250 miles, discharging in succession towards the Atlantic Ocean, the Juniata, the numerous branches of Potomac and James rivers, and into the valley of Ohio, Connemaugh, Youghiogany, Monongahela, and Greenbrier branch of Great Kenhawa. From the sources of the Tioga branch of Susquehannah, North Lat. 42° 40′, to the point where the Alleghany Mountain is pierced by New river, at North Lat. 37° 20′, or through 320 minutes of latitude, the dividing line of river source does not differ quite 3° or 180 minutes of longitude, whilst the general course of the mountain chains is in the intermediate distance something to the east of north-east.

With the valley of New river, a change again takes place; as that stream rises in the north-western valleys of Blue Ridge, the dividing ridge of water source is carried to the south-east from the Alleghany to the Blue Ridge chain, discharging very short creeks into New river, on the south-west, and giving source to Roanoke river north-east. From the geographical point where North Lat. 37° is intersected by the third degree of longitude west from W.C., and where Black Water branch of Roanoke rises on the south-east, and Little river branch of New river on the north-west side of Blue Ridge, that chain becomes the dividing line of river source, and continues so about 300 miles, discharging to the north-west the branches of New river, Watanga, Nolachucky, French Broad, Tennessee Proper, and Hiwassee, streams tributary to the Ohio; to the east the south-western branches of Roanoke; to the south-east, the Yadkin, Catawba, Broad, Pacolet, Saluda, and the numerous branches of Savannah river; and to the south-westward the extreme higher and north-eastern sources of Chatahooche and Coosa rivers.

It may be premised, that the continuation of the Blue Ridge, westward from the sources of Chatahooche and Hiwassee, is drawn on our maps, so discordant to all the other parts of the Appalachian system, as to excite a doubt of accurate discrimination of the chains. On Tanner's United States, the Blue Ridge is blended with the Unika or Iron Mountain, between the sources of Coosa and Hiwassee rivers, and represented as inflecting thence upwards of two hundred miles, separating the sources of Coosa, Black Warrior, and Tombigbee from those of the extreme southern confluents of Tennessee, and in the intermediate distance receiving the termination of all the other chains of the Appalachian system. If this geography is correct, the country it represents is an anomaly in the physical section to which it belongs.

Leaving the southern extremity of the Appalachian system to future and more scientific examination than it has yet obtained, we may proceed with our review. Sufficient well established data exist to decide the truth of the important fact, that the mountain chains of the south-western section of the Appalachian system are only incidentally, or perhaps more correctly only partially, demarcations between the sources of the Atlantic rivers and those of the great tributaries of the Ohio valley. Taking the Susquehannah at one extreme, and the Tennessee at the other, we find the former deriving its most remote western fountains from the extreme western chain, and the latter directly the reverse, or springing from the easternmost chain of the system; both rivers, in their course from source to recipient, traversing the gorges of the various chains.

It ought, however, to be noticed here, that a part of the physical appearance we have been noticing, as seen on our best maps, is deceptive. The Blue Ridge is usually marked as the outer south-eastern chain, which so far from being the fact, there are two lateral chains between it and the lower falls of the rivers. These chains will be examined in the sequel of this head, and under the survey of the respective chains of the Appalachian system, to which we now proceed.

It has already been stated, that the tide valley of the Hudson occupied only a part, and did not terminate the Appalachian system; and it may be doubted whether a single chain of that system is confined to one side of that remarkable bay. The chains are, however, more distinctly defined and set apart from each other in the basins of Delaware and Susquehannah than towards either extreme; we may therefore take the head of tide water in the two latter rivers as our points of departure in examining the respective Appalachian chains.

It would be far from an unsupported theory, as I have already observed, to consider the lower falls of the rivers as the outer margin of the Appalachian system; but beside these falls, which we may observe, are not themselves marked on our best maps, there exists a distinct, though neglected chain, which is cut through by the Delaware, about five miles below the passage of the same stream through the Blue Ridge, at the influx of Lehigh river. This overlooked chain has been confounded with Blue Ridge between the Delaware and Hudson rivers, though in no one place are the two chains really blended, or even touch each other. In New Jersey, the narrow but fine valley of Musconecung river lies below the Blue Ridge, and above the South East Mountain. Preserving a relative distance of from four to seven or eight miles, the two chains range towards the Hudson, and make their nearest approach at the Highlands. In fact, where the Hudson traverses both chains, it demands a knowledge of their prolongation each way to determine that the apparently confused masses belong really to two, and not one chain of mountains.

The South East Mountain* is, perhaps, the same as Haverstraw, between Orange and Rockland counties, New York, and traverses the Hudson valley between Peekskill and West Point; and thence inflecting with the Blue Ridge to the north-east, stretches towards and reaching is traversed again by another river, the Housatonick, in the western border of Litchfield county, Connecticut. Here once more the South East Mountain, similar to all the other chains of the Appalachian system, inflects to a course only a few degrees east of north, forming the Housatonick mountains of Massachusetts, and Green mountains of Vermont. In Massachusetts, and the southern part of Vermont, the South East Mountain is kept separate from the Blue Ridge; but between the sources of Onion and White rivers the two chains are confusedly delineated on our maps, and the name of Green mountains appropriated at different places to both chains, and in the existing state of our topographical knowledge sets at defiance accurate specific classification. We may remark, nevertheless, that, reasoning from all analogy, the two chains remain distinct beyond the limits of the United States.

Returning to the channel of Delaware river, we are able to trace the South East Mountain in its south-westward range with tolerable certainty. In common with the general conformity in the relative courses of the chains, the South East Mountain, leaving the Delaware river, curves with the Blue Ridge and Kittatinny chains, is cut by the Schuylkill above Pottstown, forming the boundary between Northampton and Bucks county; between Bucks and Lehigh, and between Berks and Montgomery and Chester counties. Thence traversing Lancaster and York counties and cut by the Susquehannah river between those two counties, passes from the latter into Maryland, which it traverses by the name of Parr Spring Ridge, having the valleys of Gunpowder, Patapsco, and Patuxent on the south-east, and Monocacy on the north-west. Immediately below the mouth of the Monocacy into Potomac, this chain rises into the remarkable Peak called the Sugar Loaf, but rapidly sinks to the gap through which flows the Potomac; it enters Virginia, within which it traverses the counties of Loudoun, Fauquier, Culpepper, Madison, Orange, Albemarle, Nelson, and Amherst, reaches James river above the town of Lynchburg. Beyond James river, the South East Mountain, maintaining its general parallelism to the Blue Ridge, separates Bedford from Campbell, and Franklin from Pittsylvania, and traversing Henry county enters North Carolina, between Surry and Stokes counties, and merges into the valley of Yadkin, having been traversed in Virginia by the Roanoke between Bedford and Pittsylvania counties.

In North Carolina the South East Mountain is traversed by the Yadkin in Surry; thence separates Wilkes from Iredell, and once more broken by a mountain stream, is traversed by the Catawba river between Burke and Lincoln. Again bending with the corresponding curve of Blue Ridge, it inflects to nearly due south, separating Rutherford from Lincoln, and entering South Carolina, between York and Spartanburg districts, is no longer noticed even in fragments, on the large State Map of South Carolina, or any other map I have seen. From the courses of the rivers, and the boundaries of the districts of South Carolina, I have no doubt of its continuity over that state to Savannah river. Of the correctness of this theory I would not speak so confidently, if I had not actually traced the same chain in New York, New Jersey, Pennsylvania, Maryland and Virginia, where it rises and extends with all the boldness and distinctness of a mountain chain, and where its existence is not represented on any map I have had the good fortune to examine. Confined to its known range in the United States, from the southern border of Lower Canada to the north-western of South Carolina, its length is about 900 miles; 300 north-eastward from the Hudson, and 600 south-westward from that tide boundary.

The Blue Ridge, if we regard the preceding as the outer chain of their common system, is the second, and following with each a similar course of survey, we trace the former, from where it is traversed by the Delaware river directly below the mouth of Lehigh. Rising from the Delaware, it ranges over New Jersey and New York, in a north-easterly direction to the Hudson, which it reaches between West Point and Newburg. Many of the river passages through mountains have been noticed and celebrated, and, amongst others, the passage of the same chain by the Potomac at Harper's Ferry, but it may be doubted, whether any other similar phenomenon on earth combines so many very remarkable circumstances as the tide stream of the Hudson through the two chains, the South East Mountain and Blue Ridge.

Profoundly deep, far below the utmost draught of the largest vessels of war, the flux and reflux of the tides rush along a tortuous channel, bounded by enormous and almost perpendicular walls of rock, rising to from one thousand to twelve hundred feet. Passing along this truly wonderful gorge, the mind involuntarily demands, by what operation of nature has this complication of wonders been formed? But what in an eminent degree enhances the surprise and wonder is, that for many miles on both sides of these great masses of granite, both chains are comparatively humble, and the river or bay, call it by either term, fills the bottom of a chasm in a series of peaks, much broader in base and far more elevated than the ordinary extent of either chain. The highest peaks, however, are above West Point, and belong to Blue Ridge. Of these peaks, the most elevated is Butter Hill, which rises to 1535 feet above the ocean tides; and rising directly from the river affords a very extensive landscape to the south-west and north.

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* I have given the name of South East Mountain to this chain from real necessity, to avoid circumlocution.

After passing the Hudson the Blue Ridge continues to the N. E. about twenty miles, and then similar to the other chains of the same system on both sides of that river, rapidly inflects to a course a very little N. of E., a direction which it maintains above two hundred and fifty miles in the states of New York, Massachusetts and Vermont. For the first seventy miles of its northerly course, the Blue Ridge discharges from the eastern slope numerous branches of Housatonick, and from the Fishkill, Wappinger's, Jansen's or Ancram, and Kinderhook creeks flowing into Hudson. With the sources of Housatonick and Hoosack rivers, the features of the Blue Ridge change; hitherto from the Hudson a line of river source, it now loses that character, and is broken into innumerable ridges by the higher sources of Hoosack and Batten Kill flowing into the Hudson; and thence by Paulet, Otter, Onion, La Moelle, and Mississque rivers falling into Lake Champlain. All these latter streams rise in the chain already noticed under the name of South East Mountain.

We may be permitted to hazard a hypothesis, that what is designated Green Mountains in the southern part of Vermont, and the ridge or series of ridges known by the same term in the northern part of the same state, are respectively fragments of the two separate chains we have been reviewing, though represented generally as the continuation of one and the same chain.

In relative elevation and mass, the Blue Ridge and South East Mountain reverse their characters on the opposite sides of the Hudson. To the south-westward the former greatly exceeds; but on the contrary, between the basins of Connecticut and Hudson, the latter gradually increasing in base and height assumes a decided superiority, and at one point, about 8 or 10 miles eastward from Rutland in Vermont, rises in Killington Peak to 4000 feet above the level of Atlantic tides. This height exceeds that of any part of Blue Ridge, except the Peaks of Otter. To this general comparison between the two chains there is one exception, however, which has been, it is true, noted already, but to avoid ambiguity may be repeated. Where the two chains are broken by the Hudson, nearly all the large and elevated peaks are parts of Blue Ridge; such as Anthony's Nose, 935 feet; Bare Mount, 1350; Crow's Nest, 1418; Butter Hill, 1535; Bull Hill, 1484; and Break Neck Hill, 1187, above tide water.

White Mountains, in New Hampshire, may be regarded as the nucleus of the north-eastern part of the Appalachian system, but so defectively have the chains been grouped as to leave the points of connection doubtful. If we examine Connecticut basin in relation to the mountains, we find that stream rising between two chains, and flowing down the intermediate valley, in the higher part of its course, and, if the expression can be admitted, entangled in the extensions of both chains, towards its final discharge into Long Island Sound.

The very striking distinction in the character of the United States coast on the south-west and north-east side of the estuary of the Hudson, will be more particularly noticed under the head of the river basins; but we merely glance on the subject in this place to remark, that the coast of the United States southwest from the Hudson is longitudinal to the Appalachian chains, whilst the coast to the north-east of that estuary, is transversal to that part of the system to which it appertains. That the general course of the Appalachian system is from south-west to north-east is only true of that section between the Hudson and Gulf of Mexico, and there, also, with great specific exceptions; but to the north-eastward of the Hudson the commonly assumed range of the mountain system is utterly in error. Over the whole Appalachian physical section of the continent of North America, the mean or general course of the rivers are along or very nearly at right angles to the range of their dependent mountain chains. This admirable natural structure prevails in the whole system, and has given to the courses of the rivers on each side of the Hudson valley, their specific characters.

From the estuary of the Hudson to the utmost bounds of the United States south-westwardly, the coast is low, and alluvial in its component materials, whilst from that estuary to the north-eastward the shore, with but trivial exception, is bold, and in many places actually rocky. To this, Cape Cod, physically, is not an exception, more than is Long Island: the former being really insular in all its essential characters, and only deviating from other islands on the Atlantic coast of the United States, in being united by a sandy neck to the main land. The boldness of the north-eastern coast is an effect in full accordance with the internal structure of the country, to which it is an immense abutment. Here, the mountains so far from extending from south-west to north-east, on the contrary, stretch in lateral chains with a very slight deviation to the south-west and north-eastward of due north and south, and the rivers flow down the intervening vallies in an astonishing manner parallel to the mountain chains, and to each other. This is the case with the Hudson, Housatonick, Connecticut, Merrimack, Kennebeck and Penobscot.

The general course of the main streams of Delaware and Susquehannah, it may be observed, correspond to the course of the north-eastern rivers, and the cause is obviously found in the bend of the mountain system in the basins of these streams. With the western confluents of the Susquehannah, however, commences that long series of rivers, which with partial bends and windings extend themselves from, and nearly at right angles to that part of the great Appalachian system south-west from the Hudson.

With this digression we return to our survey of the mountain chains.

The Blue Ridge we have traced beyond the Hudson towards St. Lawrence basin; we now pursue its range in the opposite direction. Nearly parallel, and with a very narrow intervening valley, the Blue Ridge ranges with the South East Mountain, in a direction very little declined from S. W. from the Highlands above West Point to the Delaware, immediately below the mouth of the Lehigh. In this range, with a humble general elevation the chain is complete, and discharges from the south-eastern flank the higher sources of Hackinsac and Musconecung; and from the opposite side, the upper branches of the Wallkill and Pequest.

Traversed by the Delaware, the chain commences to inflect more westward, and to widen in distance from the South East Mountain 45 miles, to where it is again cut by another river, the Schuylkill at Reading. Still deflecting westward, it continues another stretch of 45 miles to the Susquehannah, which it reaches at and below the mouth of Swatara river. Rising from the right bank of Susquehannah, the Blue Ridge commences a re-inflection to the eastward, but with little change for the first 40 miles, but thence bends to the east of south-south-east, and pursues that direction 50 miles to the Potomac, at Harper's Ferry, and though a small distance below, nearly opposite the mouth of the Shenandoah.

From the High Lands on the Hudson to the Potomac, in an aggregate distance of 180 miles, the Blue Ridge, except by the large rivers, is traversed by no other stream, and though of moderate mean elevation, is a perfectly defined chain. It is, however, only after its rise to the south-westward of Potomac, that map makers have condescended to give it a general and distinctive name. Thence known as the Blue Ridge, this chain once more inflects, and assuming a course of very nearly south-west, giving source on the south-east side to the higher branches of Rappahannoc, and some minor confluents of James river, and from the opposing side discharges creeks into Shenandoah, and gives source to the extreme fountains of South river branch of James river, continues 150 miles unbroken by any stream, to where it is traversed by James River.

Still maintaining a south-western course of 35 miles, the Roanoke traverses it, and is the last stream that interrupts its continuity in the direction of our survey. With a slight inflection westward, the Blue Ridge stretches beyond the Roanoke 170 miles, discharging from its south-east flank the sources of Dan, Yodkin, and Catawba rivers, and from the opposing side those of New River, Watauga, and Nolachucky rivers. With a deep curve to the south-eastward, the Blue Ridge, passing the sources of Catawba and Nolachucky, continues its general south-western course about 100 miles, discharges towards the Atlantic Ocean the numerous sources of Broad, Saluda, and Savannah rivers, and into the Valley of Tennessee the sources of French, Broad, Tennessee Proper, and Hiwassee rivers.

From Hudson to the basin of Roanoke inclusive, the Blue Ridge extends along the Atlantic slope; but leaving the basin of Roanoke this chain becomes the line of demarcation between the Atlantic slope and Ohio Valley or Mississippi basin, and continues so to the region where it separates the higher sources of Savannah and Hiwassee rivers.

The discordance between the delineation of the Blue Ridge on our maps, and the analogy of the Appalachian, to a very different systematic arrangement, has been already noticed under this head; we may therefore dispense with pursuing the chain where neither its existence or inflections are correctly ascertained.

If the whole range of the Blue Ridge in the United States is taken into one view, it extends from the sources of the Savannah and Hiwassee, to those of Connecticut and St. Francis rivers, and within a small fraction of one thousand miles following the inflections. Geographically it reaches from N. Lat. 35° to 45°, and in Lon. from 5° 30′ E. to 6° 30′ W. from the meridian of Washington City. Its position and length from extreme to extreme, determined by actual calculation, yields a deflection of very near 41° from the meridians, and for length 920 statute miles. The length and position of the Blue Ridge may be assumed as a scale of reference for the other chains of the Appalachian system in the United States.

The relative height of this chain illustrates the peculiar position of the whole system. These elevations demonstrate that the plain on which the chain extends rises gradually from tide water in the Hudson, to the sources of New River, or the highest constituent of the Great Kenhawa.

TABLE II.

Elevations of the River Surface at Low Water of the several rivers which traverse the Blue Ridge.

	Above Tide.
Delaware below the influx of the Lehigh at Easton,	160
Schuylkill at Reading,	178
Susquehannah, below the influx of Swatara,	276
Potomac at Harper's Ferry,	282
James River, below the union of its two main Forks, and at the passage of the Blue Ridge,	670
Roanoke at the passage of the Blue Ridge,	1000
Base of Blue Ridge at the sources of Yadkin and New River,	2000

The mean height of this chain falls short of one thousand feet, if taken from its base, and does not amount to two thousand if estimated from tide water. It usually stretches in one, two or three sharp ridges, clothed with timber to the summit. There has no vestige of any volcanic eruption been discovered and made public in this or any other Appalachian chain.

The few peaks in the Blue Ridge are composed of rocks piled on each other, and when examined, appear the remains of masses of much greater magnitude. The Peaks of Otter in the northern part of Bedford county, Virginia, N. Lat. 37° 23′, and between James and Roanoke rivers, are the highest points in the Blue Ridge, and of the whole system south-west from the Delaware, and they are only 4250 feet above the surface of the Atlantic Ocean.

The great difference of elevation, however, between its two bounding plains, is more remarkable in the Blue Ridge than in similar phenomena of any other chain of the Appalachian system. The subjoined Tables of elevations along both plains or valleys, will illustrate the preceding remarks.

TABLE III.

Elevations above Atlantic Tide Water of Places on the Valley between South East Mountain and Blue Ridge.

	Feet.
Montpellier, in Vermont,	394
Pittsfield, in Berkshire county, Massachusetts, and in the valley of the Housatonick near its source,	945
Dover, Morris county, New Jersey, and on the Morris Canal, and E. of Blue Ridge,	570
City of Lancaster,	349
Columbia, on the Susquehannah,	220
Upper Point of Rocks on the Potomac, where Baltimore and Ohio Rail Road reaches that stream,	200
Lynchburg, Campbell county, Virginia, level of James river at,	500
Level of James river, immediately below the Blue Ridge,	636
Roanoke, valley of, in Bedford and Franklin counties, Virginia, mean elevation of about	800
North Carolina, mean height of Surry, Wilkes, Burke, and Rutherford counties, bounding on, and sloping south-eastward from the Blue Ridge,	800

TABLE IV.

Elevations above Tide Water of the Atlantic Ocean, of various Places in the Great Valley above Blue Ridge, or between that Chain and Kittatinny Mountain, south-westward from the Hudson.

	Feet.
Drowned Lands, from which flow the sources of the Wallkill into Hudson, and those of Pawling's creek into the Delaware, about	400
Easton, on the Delaware, on the Point above the junction of that stream with the Lehigh,	186
Bethlehem, Bridge, the level of Lehigh at	261
Allentown or Northampton in Lehigh county,	300
Reading,	178
Hamburg, level of the Schuylkill at, immediately below the passage of that stream through the Kittatinny chain,	362
Womelsdorf, on the Union Canal,	360
Lebanon, on the do. do.	480
Middletown, above the mouth of the Swatara,	276
Harrisburgh, the centre of the borough, about	300
Chambersburgh, near the sources of Conecocheague and Conedogwinet rivers, say	400 ?
Williamsport, on the Potomac, immediately below, and on the same side with the mouth of Conecocheague, the village,	450
Williamsport, level of Potomac at,	355
Harper's Ferry, water level at,	282
Shenandoah and James rivers, sources of,	
Pattonsburg, at the Great Bend of James river in Botetourt county, Virginia,	806
James River, at the influx of Cowpasture river,	995
Covington, at the junction of Jackson's river with Dunlap's creek, and where the united waters take the name of James river,	1224
Salem, on the Roanoke,	1002
Forks of Roanoke,	1178
Summit level between the sources of the Southern Fork of Roanoke and those of Little river branch of New river,	2049
Little river and New rivers, junction of	1740
Little river, sources of, where they interlock with those of the Watauga branch of Holston, at least	2500
From the sources of New river, the north-western slope of Blue Ridge depresses along the sources of Nolachucky, French Broad, Tennessee Proper, and Hiwassee rivers, but at the extreme Table Land from which flow the higher sources of Savannah, Chatahooche, Coosa, and Hiwassee, the mean elevation, without estimating the mountain ridges, must be above	1500

Tables III. and IV. are in great part constructed from elements procured from actual admeasurement, and will serve to exhibit the great elevations and depressions of, perhaps, the most remarkable mountain valley, not only in the United States but on the earth. Before, however, proceeding to close the description of the intervening valley, we shall proceed to trace the succeeding chain to the Blue Ridge, the Kittatinny.

One of the greatest difficulties in classifying the Appalachian chains, is the want of general names; a deficiency arising from another disgraceful want, a scientific survey of the whole system. Such a survey, would, it is probable, connect the Shawangunk ridge with those to the eastward of the Hudson. To the westward of that stream, in the lower part of Ulster county, New York, and between the Rondout creek and Wallkill, or rather between Rondout and Shawangunk creeks, ridges of mountains are found rising, and ranging thence south-westward towards the Delâware. These ridges are the commencement to the south-west of the Hudson of the *Kataatin Chunk*, or, as we have corrupted the Indian term, the Kittatinny chain.

Extending about 40 miles between the Shawangunk and Nevesink rivers, the Kittatinny is reached by Delaware river, at the extreme northern angle of New Jersey, and at the mouth of Nevesink. From this point the mountain chain deflects the Delaware, and the river and mountain stretch nearly parallel to each other, south-westwardly 36 miles, to the Delaware Water Gap. Here the river assumes a southern course and traverses the mountain; whilst the latter again rising and inclining a little more to the westward, stretches 28 miles to where it is traversed by the Schuylkill, above the village of Hamburg. Inclining so much more to the westward as to lie nearly S. W. by W., the Kittatinny extends 30 miles from the Schuylkill Water Gap to where it is pierced by the Swatara. Between the latter point and the Susquehannah, five miles above the borough of Harrisburgh, in a distance of about 22 miles, the direction of the chain is something W. of S. W., and pierced by several small confluents of Swatara, it is there broken into successive ridges.

Beyond the Susquehannah, the Kittatinny again rises, and extending first nearly west between the confluents of Conedogwinet and Shareman rivers; thence broken into ridges bounding on the westward the valley of the Conecocheague, the chain gradually curves to the southward and reaches the Potomac, extending very little west of south. Rising again beyond the Potomac, between the Opequan and Back creeks, it assumes a very near parallelism with the Blue Ridge, is passed by the North Fork of Shenandoah, and extends thence between the two main branches of that river. Though scarcely appearing on our maps, the chain of Kittatinny remains continuous over Rockingham, Augusta and Rockbridge counties of Virginia into Botetourt, to where it is traversed by James river below the mouth of Craig's creek. Still faintly represented, the chain stretches along the higher sources of James and Roanoke rivers to the centre of Montgomery near Christiansburg, where it merges from the Atlantic slope into the valley of Ohio, by entering the sub-valley of New river or Upper Kenhawa.

Thus far, in all its range from the Hudson, the Kittatinny chain is broken into links by the higher sources of the Atlantic rivers, and similar to the South East mountain and Blue Ridge the base gradually rises, ascending the vast inclined plain obliquely, until it reaches the highest apex between the sources of Roanoke and Little river. Here the lowest gap, through which a projected canal is intended to be carried, is 2049 feet above the level of the Atlantic Ocean. See Table IV. The chain now inflects to a course considerably west of south-west; and is traversed by New river or Upper Kenhawa. Beyond the latter stream, under the local name of Iron mountain, discharging to the eastward the confluents of New river, and from the opposite flank those of the south branch of Holston and Watauga, reaches the extreme north-eastern angle of Tennessee.

At the preceding remarkable natural and political point, the chain assumes a direction very nearly to the S.W., and under the various names of Iron mountain, Bald mountain, Smoky mountain, and Unika mountain, pierced in succession by Watauga, Doe, Nolechucky, French Broad, Big Pigeon, Tennessee Proper, and Hiwassee, according to Tanner's United States, merges into Blue Ridge in the northern part of Georgia, between the sources of Coosa and Hiwassee rivers.

If the whole mass of the Kittatinny is taken into the estimate, it exceeds the Blue Ridge, though no peak of the former rivals in elevation the peaks of Otter. Both chains are almost every where in a natural state clothed with timber.

In the existing state of our mountain geography it is impracticable to attempt a systematic review of the chains beyond the Kittatinny.

Alleghany Mountain, or the main spine of the system, has received no more definite delineation than the minor chain, and it is evident from the analogy of the system that the term Alleghany is applied to ridges of different chains. Where exact information cannot be given, silence is best; but with a view to stimulate to future inquiry, I shall hazard the hypothesis, that the Catsbergs or Catskill mountains of New York are a part of the same chain with the Alleghany of Pennsylvania, Maryland, and Virginia.

Catskill mountains, properly to called, rise very abruptly from the valley of the Hudson, discharging northwardly the Schoharie river into the Mohawk, westwardly the extreme sources of Susquehannah, and south-westwardly the sources of Coquago and Popachton rivers, or the two main constituents of Delaware river. The Catskills are part of a mountain nucleus, rising into peaks from 3000 to 3500 feet above the tide level. From this burr, if the term is admissible, two chains.

The first or minor chain extends south-westwardly towards the Delaware, and between the sources of Nevesink and Popachton rivers; traverses Delaware river, and is mingled with the numerous chains between the Kittatinny and north-east branch of Susquehannah.

The principal chain, however, which stretches from the Catsbergs, extends also south-westwardly between Coquago and Popachton rivers; is traversed by the main volume of the former, and rises in Pennsylvania by the local name of Tunkhannoc mountain. The latter name is continued to where the chain is broken by the passage of the north-east branch of Susquehannah river, below the influx of Tunkhannoc river. Between the two main branches of the Susquehannah, this chain inflects to S.W. by W. in full conformity with the corresponding direction of the South East Mountain, Blue Ridge, and Kittatinny, and by the local name of Bowman's mountain, reaches and is traversed by the west branch of Susquehannah, at the Great Bend below Pennsboro'; thence extending very nearly due west by the name of White Deer mountain and other local terms, merges into the valley of Bald Eagle creek, and sweeping to S.W. assumes the distinctive name of Alleghany Mountain.

The length of the chain from the Catsbergs to where it is unequivocally known as Alleghany, is about 200 miles. Curving round to S.S.E. between the sources of Bald Eagle and Juniata on the eastward and the sources of the West Branch westward, the base of the Alleghany reaches the summit between the Atlantic slope and Ohio valley, discharging the higher branches of Juniata eastward, and those of Kiskiminitas westward. It is this part of the Alleghany which is traversed by the rail road to connect the two branches of the Pennsylvania Canal. The summit level where the road is to pass, is by admeasurement 2291 feet above tide level, but so rapid is the descent on both flanks of the chain, that Frankstown, on a western branch of Juniata, and almost at the eastern foot of the mountain, is only 910, and Johnstown, at the forks of Kiskiminitas, about 16 miles westward from the mountain, is 1154 feet above tide level.

From where the Pennsylvania Rail Road passes the Alleghany, to where it is intended to be traversed by the Chesapeake and Ohio Canal, is about 40 miles, the intermediate direction a very little W. of S. At the passage of the Chesapeake and Ohio Canal, the Alleghany is again elevated 2754 feet above tide level, but here also the descent each way is so rapid, that Cumberland, on the Potomac, close upon the eastern slope of the chain, is only elevated 573 feet above tide water, and on the opposite flank, where the declivity is less abrupt, the falls of Youghiogany river is only 1170 feet above tide level.

The preceding elements demonstrate the very unequal depression of the two valleys which lie on each side of the Alleghany chain. The valley westward is a real and not very lightly elevated table land, rising from 900 to 1200 feet above the oceanic level.

With that part which separates the sources of the north-western confluents of Potomac from those of Youghiogany, terminates the certain geography of the Alleghany chain. As delineated on Tanner's United States, it is carried in continuity from the sources of Kiskiminitas and Juniata to New river S.S.W. and gradually inclining upon or towards Kittatinny and Blue Ridge. In the valley of Potomac, the latter and Alleghany are upwards of 70 miles asunder, whilst at the sources of Roanoke and James rivers, the two chains approach to within less than 30 miles; and as the Alleghany is drawn between the extremes along the real separating line of the river sources, we may from analogy doubt the correctness of the delineation. Judging from the structure of the system, it would appear that the continuation of the Alleghany chain from the sources of Potomac, James, and Monongahela rivers, is to be found in Green Briar Mountain, between Green Briar and Gauley rivers, and again beyond the Kenhawa in the Great Flat Top Mountain. If this conjecture is correct, what I have long suspected will follow, that Powell's mountain, between Powell's and Clinch rivers, is a ridge of the Alleghany chain.

Where, on any map of the United States, the mountain chains are represented inflecting with the dividing line of river source, the accuracy of the mountain representation may be doubted. It is directly contrary to the character of the Appalachian mountain ridges to inflect with the water courses, though in innumerable instances the ridges are separated by the water channels. The channels, as already observed, flow generally along or at right angles to the mountain valleys. But it is the circumstance of the chains, being so frequently traversed by the streams, which render the true delineation of the latter so difficult. The intricacy would, however, in great part disappear, if a careful and skilful survey was made of the whole Appalachian system.

From the double confusion produced by nature and the want of correct maps, we may be excused from an attempt to describe, or even name, the numerous chains and ridges which extend between the Kittatinny and Alleghany chains. To the interior or westward of the latter, I have traced two lateral chains from the sources of the Monongahela into the state of New York. Though inferior in height above their bases to the chains more eastward, the western part of the system is in a peculiar manner distinctly defined in nature. Between the Youghiogany and the Kiskiminitas rivers, the easternmost of these western chains is called Laurel Hill, and the westernmost designated Chesnut Ridge; but with unequalled absurdity, the names are reversed between Cheat and Youghiogany. With the Kiskiminitas valley, these two chains are omitted on some maps, and confounded on others, but really remain distinct and defined to the sources of Genessee river. A similar observation may be made on the geography of the same chains in an opposite direction. Along the comparatively great distance of two hundred miles from the valley of Cheat river to that of the West Fork of Sandy river, they are again omitted, though there also distinct and defined.

Which of the more northern chains is continued in Cumberland Mountain, it is impracticable to determine from the representation of the maps. The Cumberland chain becomes distinct as the boundary between Virginia and Kentucky, on the higher sources of Sandy, Kentucky, Cumberland, and Powell rivers. The direction of the chain from the West Fork of Sandy river to Cumberland Gap, at the point where Virginia, Kentucky and Tennessee unite, in a distance of 85 miles, is to the west of south-west. Entering Tennessee, where, in a distance of two hundred miles, it maintains a general course of a little W. of S.W., but with a large curve to the north-west, this chain discharges from the western flank the numerous sources of Cumberland river, and from the opposite side the north-western streams of Upper Tennessee. From Tennessee it merges into Alabama, within which, about 40 miles, it reaches and is traversed by the main volume of Tennessee. Beyond Tennessee river, the Cumberland chain is quickly lost amongst the hills which separates the valley of that stream from that of the Black Warrior branch of Tombigbee.

The passage of Tennessee river through the

Cumberland chain is a very remarkable point in the physical geography of the United States. See Art. Tennessee River, Vol. XVIII. pp. 666—7.

Between the valley of Sandy river and its reaching Tennessee river, in a distance of 325 miles, the Cumberland chain is a dividing line of river source, and in many parts presents an impassable wall of rock. If we, however, compare the mountain system with the great inflections of the Ohio, Kentucky, Cumberland, and Tennessee rivers, we discover the influence of the former over the channels of the latter far westward of any regularly delineated chain. Similar observations have been made on the structure of the Atlantic slope, eastward of the Appalachian system. Restricting the system, nevertheless, to the space over which distinct chains extend in the United States, it stretches along something above one thousand miles. The breadth is generally not far from one hundred and seventy; of course, the physical section of the United States embraced by the Appalachian system, comprises one hundred and seventy thousand square miles. This physical region, though mountainous, is very far indeed from uniform in appearance, or in soil. The intermediate valleys between the chains are real table lands, varying in elevation above the Atlantic tides, from 500 to 2500 feet. It has been shown in this article, that the chains traverse obliquely over the river valleys on both sides of the summit of the river source. We have also briefly traced the main chains, but so numerous are the intervening ridges, and so defective all delineations of their position, or even individual existence, that it is utterly impracticable to determine to any decided exactness the space actually occupied by mountains. The number of chains may be assumed at 12, and the mean breadth of their bases at three miles, without much danger of great error either way. This would yield an aggregate length of mountain of 12,000 miles, and the area occupied by the chains at 36,000 square miles; leaving for the intermediate table lands 134,000 square miles.

We now proceed to a specific description of the rivers flowing from this great mountain physical section, commencing with the Alatamaha, and advancing north-eastwardly along the Atlantic slope to the St. Johns of Maine and New Brunswick, and returning to the Alatamaha, and proceeding by the opposite direction to complete the circuit of the system.

Alatamaha is formed by two main branches, Oconee and Ocmulgee. Both confluents have their sources in the lateral spurs of the Appalachian chains, and, what is very remarkable, in a distance of seventy miles the remote fountains of both streams rise from five to ten miles from the main channel of Chatahoochee river. The Oconee, or eastern branch, rises between the sources of Broad river branch of Savannah and Soquie branch of Chatahoochee river, at North Lat. 34° 18′, Lon. W. from W.C. 6° 40′, and in Hall county, Georgia. Flowing thence S.S.E., by comparative courses, 175 miles, receives the Ocmulgee, almost exactly on North Lat. 32°. The valley of the Oconee is narrow, when compared with its length, being under fifty miles where widest, and not much, if any, exceeding a mean breadth of 25 miles.

The Ocmulgee is, in fact, the main stream, both as to length of course and surface drained, and rising at North Lat. 34°, Lon. 7° W. from W.C. in Gwinnett county, Georgia, flows thence 170 miles, by comparative courses, and, in a remarkable manner, parallel to, and distant about 35 miles from the Oconee. Sweeping round to east and north-east, the Ocmulgee joins the Oconee between Montgomery and Appling counties.

The entire upper valley of the basin of Alatamaha is in length 170 miles, and having a mean breadth of 60, comprises an area of 10,200 square miles.

Below the union of its two main constituent streams, the Alatamaha pursues a comparative course of about ninety miles, in a south-eastern direction, to its entrance into the Atlantic Ocean, at the northern extremity of St. Simon Island, North Lat. 31° 19′, and Lon. W. from W.C. 6° 22′.

The lower valley of the Alatamaha basin is narrow, only one stream entering that deserves the name of a river, and that, the Great Ohoopee, from the north-west, is an unimportant branch, of about eighty miles comparative course. The entire basin of Alatamaha extends in length 260 miles from south-east to north-west, with a mean breadth of fifty miles; area 13,000 square miles. This basin is bounded by the higher valley of the Chatahoochee north-west; by the valley of Flint river west; by the sources of Swanee and Santilla rivers south; basin of Great Ogeechee south-east; and the basin of Savannah to the north-east.

As a commercial and habitable basin, that of Alatamaha is of great importance. There is at low tide 14 feet water on the outer bar, and ships of that draught can be navigated some distance up the main stream. Steam boats are navigated up the Oconee to Milledgeville, and both Oconee and Ocmulgee are navigable for down stream vessels to near their respective sources.

A comparatively minor basin, the Ogeechee, or Ogatchee, follows that of Alatamaha. The sources of the Ogeechee originate to the south-east of all the distinct chains of the Appalachian system, at about North Lat. 33° 30′, Lon. 6° W. from W.C., between Little river branch of Savannah and Oconee, and in Greene county, Georgia. The valley or basin of Ogeechee is narrow, and lies in a direction from north-west to south-east. Length about 170 miles, with a mean width of 30; area 5100 square miles. The main stream receives but one tributary of any consequence, the Cannouchee. The latter has its valley between those of Ohoopee and the Great Ogeechee, and gains some importance from its position. The entire length falls short of ninety miles, but the lower part of its course above its junction with the Ogeechee being from west to east, the channel lies directly in the course of a projected canal to unite the Savannah and Alatamaha rivers. Ossabaw Sound, which receives and terminates the Great Ogeechee, is in North Lat. 31° 50′, Lon. 4° 7′ W. from W.C.

The very important basin of Savannah follows those of Alatamaha and Great Ogeechee. The two higher constituents of Savannah river, the Chatuga and Seneca, both originate in the Blue Ridge, at about North Lat. 35°, and Lon. 6° W. from W.C. According to Tanner's United States, both of the higher sources of Savannah rise in North Carolina. The Chatuga, or western branch, flows first south-westward, receives the Turoree, and, bending to south-east, takes the name of Tugaloo, and joins the Seneca at the passage through one of the Appalachian chains, supposed the South East Mountain.

The Seneca rises in the Blue Ridge, to the eastward of the sources of Chatuga, and westward of those of Saluda, and, flowing a little east of south, unites with the Tugaloo to form the Savannah. The comparative length of the two constituent branches are about equal to 50 miles each. Below South East Mountain the united waters now form the Savannah, and a navigable stream flows south-eastward, by comparative courses, to the entrance of Broad river, from the west.

Broad river, if length of course and surface drained are combined, is the largest confluent of Savannah. Its valley occupies the space between the higher sources of Oconee and Chatahoochee, and the valley of Savannah itself. Length about 70 miles, in a direction from N.W. to S.E. Below the influx of Broad river, the Savannah maintains nearly its original course of south-east to North Lat. 33°. Here this river inflects to the south of S.S.W., and continues that direction about 80 miles, to the city of Savannah. Widening into a bay, the channel inflects to S.E. by E. below the harbour of Savannah, and, at a distance of about 14 miles, opens to the Atlantic Ocean between Turtle and Tybee islands, at North Lat. 32°, and Lon. 4° W. from W.C. According to Tanner's map, the two geographical lines intersect in the southern side of Savannah bay. The entire basin traverses a small fraction above three degrees of latitude, and two and two-thirds of longitude. The length is very nearly 250 miles, but for such a length the breadth is confined. For 60 miles from the mouth to the entrance of Brier river, the breadth falls short of 15 miles. Above the influx of Brier river, the basin slowly widens, but where the width is greatest, from the sources of Stevens creek to those of Little river, it still falls under 70 miles, and the mean width is fully estimated at 40 miles, and the area at 10,000 square miles.

If the three basins of Alatamaha, Ogeechee, and Savannah are united into one physical section, it will comprise 27,300 square miles, lying between North Lat. 31° 19′ and 35° 5′, and between Lon. 4° and 7° 30′ W. from W.C.

The actual elevation of the Blue Ridge, where it discharges the extreme fountains of Savannah river, has never been well determined, but the most elevated arable soil must exceed 1500 feet, or an equivalent to three degrees of latitude in regard to mean temperature. With this allowance, the climate of the section under review has extremes of temperature equal to 6¾ degrees of latitude. The surface is variegated from a monotonous alluvial ocean border to mountain vallies, presenting scenery bold, grand, and even sublime. The contrast of vegetable production is the greatest to be found in any equal geographical extent in the United States. On the islands and alluvial banks of the streams of the southern and lowest part, the orange and lemon tree, the sugar cane, and other tender plants flourish. Rising from this tropical flat to the steeps of the Appalachian chains, the region of cotton is passed, and that of the apple and cereal gramina reached.

The Savannah basin is the connecting link which unites the Atlantic slope with the valley of Ohio, and with the Gulf of Mexico direct, by the channel of Chatahooche river. It is not probably one mile from the extreme sources of Chatahoochee, Hiwassee, and Savannah rivers. Yet such is the boldness of design conspicuous in the United States, that over this very elevated region, canals of intercommunication have been projected. Steam boats ascend the Tennessee to Port Deposite, at the lower side of the passage of that river through Cumberland Mountain, and canals or sluice navigation have been proposed thence up Tennessee and Hiwassee, to connect the latter with the Coosa and Savannah rivers: and again it has been proposed to join the latter and Chatahooche river by a canal. These projects are in great part not even so far realised as to have the routes surveyed. The upper channel of Savannah itself has, however, been much improved as a navigable channel, by the application of sluices and dams, an improvement aided by a prudent attention to the most practicable work in the first instance.

Another line of canals, of more immediate utility, and of greatly more facility of execution, than any line passing over the Appalachian chains, is one from Savannah river, above the city of Savannah, to the Alatamaha. In the month of December 1825, acts passed the legislature of Georgia for the construction of two canals; one the Savannah and Ogeechee canal, and the other the Ogeechee and Alatamaha canal. The former is to extend from the upper part of the city of Savannah, in a S.W. by W. direction 16 miles, to the Great Ogeechee river; and the latter, in a direction a little S. of W., 50 miles from the Great Ogeechee, to strike the Alatamaha at or near the influx of Ohoopee river.

The board of public works for Georgia was created 29th December 1825, by an act of the legislature of that state, with the express design of uniting the Atlantic part of the state with its western rivers, by means of canals and rail-roads; and in extension, by future works of a similar nature, connect the Georgia navigation with the waters of Mississippi and Tennessee. It is also made the special duty of the board of public works, to meliorate the channel navigation of the Ocmulgee, Oconee, and Alatamaha, and to examine, with a view to remove obstructions from, or erect useful improvements in, the outlets of the rivers debouching into the Atlantic.

Amongst the peculiarities which distinguish the Savannah river, may be noticed that by the channels of Chatuga and Tugaloo, and again by Savannah proper; it is in all its length from N.

Lat. 35° to the ocean, a boundary between Georgia and South Carolina.

If we extend our view into the interior as far as the Blue Ridge, the basin of Santee follows that of Savannah, but along the Atlantic coast, and as high as the lower falls of the larger rivers, there spreads a series of minor basins, the higher sources of which originate on the ocean alluvion. From the peculiar direction of Savannah and Santee rivers in the lower part of their courses, the intermediate space is nearly in form of a triangle, the side along the Atlantic Ocean about 100 miles, and the two other sides 130 miles inland to the sources of Edisto river, and respectively nearly parallel to the general courses of Savannah and Santee rivers. This alluvial basin extends over an area of 6500 square miles, extending in Lat. from 32° 05′ to 33° 55′, and in Lon. from 2° 26′ to 4° 33′ W. from W.C. Beside many of lesser note it is drained by Coosa, Combahee, Edisto, and Ashley and Cooper rivers. The ocean border is excessively broken by islands, sounds, and interlocking water courses. The principal islands are, advancing from the Savannah outlet to that of Santee, Hilton, St. Helena, Hunting, Port Royal, Ladies, Reynold, Edisto, Wadmelaw, Johns, Kiawaw, James and Coffin, S.W. from Charleston harbour. and Sullivan, Dewees, Bull and Murphey, between Charleston harbour and the mouth of Santee river.

The inlets are numerous but generally shallow; but as commercial channels may be named, Calibogue Sound, Port Royal Entrance, or the outlet of Broad River; St. Helena Sound, or the estuary of Cambahee and South Edisto rivers; North Edisto, or the southern outlet of Stono river, between Edisto and Wadmelaw and Kiawaw islands; northern or rather north-eastern Stono river, between Kiawaw and James islands; the harbour of Charleston, or the united estuaries of Ashley and Cooper rivers, and Bull Bay.

Santee basin follows that of Savannah towards the mountains, and that of Edisto on the margin of the Atlantic Ocean; and so very confined is the space between their mouths, that Pedee may be united with Santee in one physical section. If thus combined, the united basins of Santee and Pedee extend from N. Lat. 33° 05′ at the southern mouth of Santee, to N. Lat. 36° 38′, at the head of Tom creek branch of Yadkin, in Patrick county, Virginia; and in Lon. from 1° 38′ W. from W.C. at the sources of Waccamaw river, to 5° 40′ W. from W. C. at the extreme western fountains of Saluda river. The higher sources of this physical section are in the south-eastern slopes of Blue Ridge, in a distance of 180 miles, from the northern sources of the Yadkin in Patrick county, Virginia, to the extreme sources of Saluda river, in Pickens and Greenville districts, South Carolina. But, though reaching the Atlantic Ocean almost at one point, the intermediate direction of the secondary streams are very different.

Santee river is formed by two great confluents, Congaree and Catawba rivers. The Congaree, or south-western branch, is again formed by the confluence of Broad and Saluda rivers.

Saluda rises in the vallies of Blue Ridge, opposite the sources of Tennessee Proper, and between those of Seneca and Ennoree rivers, and in Pickens and Greenville districts, South Carolina. Flowing by comparative courses south-east by east 130 miles, but with a considerable elliptical curve to the southward, the Saluda joins Broad river at Columbia, and at the intersection of N. Lat. 34°, and Lon. 4° W. from W.C.

The Ennoree, Tyger, and Pacolet, are three comparatively long streams originating in Blue Ridge, between the sources of Saluda and Broad rivers, and opposite those of French Broad river. Flowing to the south-eastward and nearly parallel to each other, the Ennoree, Tyger and Pacolet enter Broad river separately.

Broad River, the north-eastern branch of Congaree, rises in the vallies of Blue Ridge, between the sources of Pacolet and Catawba rivers, and opposite those of French Broad. Supplied by numerous streams from the great valley of Rutherford county, the general course of Broad river is in the higher part of its course, only a little S. of E., but on entering South Carolina between York and Spartanburg districts, the channel rapidly inflects to S.S.E. which course it maintains about 100 miles in direct distance to its junction with Saluda, at Columbia. In its course in South Carolina, the confined space between it and the Catawba admits of no large confluent on the left; those from the right, the Ennoree, Tyger and Pacolet, have been already noticed.

Below Columbia, where the stream passes the outer primitive ledge, it takes the name of Congaree, and sweeping a curve to the south but by a general comparative course of 35 miles, unites with Wateree to form Santee. The Congaree valley embraces a triangular tract of 160 miles base, from the sources of Saluda to the mouth of Congaree; perpendicular 80, and area 6400 square miles. Though not so long by any branch as the Catawba, in surface drained and quantity of water discharged, Broad river is the main constituent stream of Congaree.

The Catawba rises in the valley between the Blue Ridge and South East Mountain, but contrary to the general course of the higher branches already described, that of Catawba is to the north of east for the first 60 miles of its course, draining the valley of Burke county, North Carolina. Thence traversing the South East Mountain, the channel abruptly inflects to a course only a little east of south. The latter direction is continued with partial windings over 2 degrees of latitude, and by comparative courses about 150 miles to its junction with the Congaree. The valley of the Catawba is about 200 miles in length, but does not exceed a mean breadth of 30 miles; area 6000 square miles.

Below the union of its two constituent streams, the Santee inclines for a distance of about 30 miles a little east of the general course of Catawba, thence inflecting 25 miles to a little north of east, and finally bending to south-east by east 50 miles, falls into the Atlantic Ocean by two outlets. The eastern cape of Cedar Island between the two mouths of Santee, is on Tanner's U. S. laid down at N. Lat. 33° 06′ and Lon. 2° 18′ W. from W.C.

The entire basin of Santee is 250 miles in length, from the mouth of Santee to either the extreme head of Saluda or Catawba; the utmost breadth is 125 miles across the higher branches; but as the basin comes almost to a point at the junction of Saluda and Congaree, and as it is confined to less than 10 miles wide along the main volume of Santee, the mean width may be assumed at 50, and the area at 12,500 square miles.

The Pedee of South Carolina is the Yadkin of North Carolina. Under the latter name this river has its most remote source in the valley between the Blue Ridge and South East Mountain, interlocking sources to the south-westward with those of Catawba; to the north-east with those of Dan river branch of Roanoke; and opposite to those of the Watauga and New River. Similar to the Catawba, the upper Yadkin flows to the north of east; the first 60 miles of its course draining the valley comprising Wilkes and Surry counties, North Carolina, and augmented by numerous confluents from Blue Ridge. Traversing the South East Mountain between Stokes and Surry, the channel bends by more than a right angle, and assumes a course in a very remarkable manner parallel to the Catawba and Santee; a course which it preserves, with partial windings, through 250 miles to its mouth at Georgetown entrance. Winyaw Point on the north side of Georgetown entrance, is at N. Lat. 33° 11′, Lon. 2° 14′ W. from W.C.

If, as stated in Armroyd's Treatise on the Internal Navigation of the United States, page 416, it is 247 miles along the channel of the Yadkin from Wilkesville, in North Carolina, to Cheraw Hill, 6 miles within South Carolina, and thence to Georgetown 270, in all 514 miles, the actual channel must be double that of the comparative length of the river.

In South Carolina the name of this stream changes from Yadkin to Pedee, and the latter term is used where the whole basin is intended to be expressed. That basin extending from Georgetown Entrance in a direction of N.N.W. 250 miles, with a mean width of 70, embraces an area of 17,500 square miles. Though the main volume receives no tributary from either side, bearing a near proportion in length of volume or surface drained to the whole basin, yet the confluents are numerous, and some of considerable commercial importance. From the right, advancing from source to mouth, enter in order, beside many more of minor extent, Little Yadkin, Rocky river, Lynche Creek, and Black River: and on the opposite side, proceeding in a similar direction, the main volume is augmented by Ararat river, Little Pedee and Waccamaw rivers, and by innumerable creeks.

The western confluents of this basin may be passed over without specific notice; but more attention is due to Little Pedee, and the very remarkable Waccamaw river.

Little Pedee rises in Montgomery and Moore counties, North Carolina, from which under the name of Lumber river, and between and at nearly equal distances from Yadkin and Cape Fear rivers, it flows 70 miles to the S.S.E., joins with and loses its name in that of Little Pedee. The latter in a general southern course of 40 miles falls into Great Pedee, 25 miles N. from Georgetown.

Waccamaw river rises in Bladen county, North Carolina. It is in reality the drain of an extensive swampy tract between Cape Fear river and Little Pedee river. Leaving Bladen, this curious stream assumes the form of a river, and separating Brunswick from Columbia county, bends from a southern to a south-western course, enters Hony District, S. Carolina, within 8 miles from the Atlantic Ocean at Little River Inlet. In place, however, of flowing onwards to the ocean, the channel inflects with the coast for 10 miles, curves thence inland to 12 miles from the coast at Conwaysboro, and again inclining very gradually towards the ocean for 20 miles, and reaching within 3 miles, once more declines from, but flows very nearly parallel to the coast another stretch of 18 miles, finally falls into Winyaw Bay or the estuary of Pedee. Thus, for upwards of 60 miles, the channel of Waccamaw follows the inflections of the Atlantic coast at a distance of from 3 to 12 miles.

The general bearing of river courses, and the character of the Atlantic coast, so greatly change, as to fully justify engrouping into one physical section the basins of Alatamaha, Ogeechee, Savannah, Edisto, or Charleston, Santee and Pedee.

TABLE V.

Summary of Extent and relative Position of the Basins of Alatamaha, Ogeechee, Savannah, Charleston, Santee and Pedee.

Basin.	Length.	Mean Breadth.	Area in square Miles.	Between Latitudes. N. Lat		Between Longitudes.
Alatamaha,	260	50	13,000	31° 15′	34° 28′	4° 22′ to 7° 20′ W.
Ogeechee,	170	30	5,100	31 42	33 36	4 02 to 6 05 W.
Savannah,	250	40	10,000	31 49	35 08	3 52 to 6 45 W.
Charleston,	130	50	6,500	32 03	33 50	2 26 to 4 33 W.
Santee,	250	50	12,500	33 05	36 03	2 12 to 5 45 W.
Pedee,	250	70	17,500	33 10	36 35	2 10 to 4 40 W.
Aggregate,	380	170	64,600	31 15	36 35	2 10 to 7 20

The improvement of this fine physical section, by canals, has not been yet very extensively effected, though much has been planned. In 1818, the Yadkin Navigation Company had that river surveyed from Wilkesville, in North Carolina, to Cheraw Hill, in South Carolina; distance by the windings, 247 miles, and by an estimate based on the survey, it was stated, that at an expense of $250,234, boats of 10 tons could be navigated, exclusive, however, of the rapids of Montgomery.

Below Cheraw to Georgetown, distant along the windings, 270 miles, the state of South Carolina has bestowed considerable attention on clearing the bed of Pedee; and on this part of the stream, so tortuous is the channel, that short canals at the bends, it is determined, would shorten the distance from 180 to 200 miles.

From the very peculiar course of Waccamaw river, its connexion by canal with Cape Fear river was an obvious suggestion on a review of their joint representation on a map. The Waccamaw is in its natural state navigable for about 70 miles of its course, by vessels of 100 tons burthen, and from the head of navigation to a point near Wilmington, distant between 30 and 40 miles, a canal is proposed. If properly executed, this would be a most invaluable addition to the internal navigation of the United States, and become of immensely augmented consequence when viewed in connexion with another chain of canals from Georgetown to Charleston. The latter line will include a short canal already formed from Winyaw Bay, or the estuary of Pedee, into the northern arm of Santee, and thence over Cedar Island, across the southern arm of Santee, and thence parallel to the coast of the Atlantic Ocean to Wando river, and down that stream into Cooper river, nearly opposite the north-east angle of the city of Charleston. Length from Georgetown to Charleston, 45 miles.

There is perhaps not another range of ocean coast in America, where one line of canal improvement would more naturally suggest another, than on the region we are reviewing, nor any other where nature has effected more to guide and aid the efforts of man.

It has been suggested to take advantage of the many interlocking streams, and of short cuts by canals, to carry a chain of uninterrupted inland navigation from the harbour of Charleston to Savannah river.

Nature has done more than three-fourths of all the labour necessary to effect the latter route. From Ashley river, directly opposite the west side of the city of Charleston, Wappoo Cut leads into Stono river, which encircling to the northward Johns and Wadmelaw Islands, joins North Edisto, or Dawho river, and by the latter leads into the main Edisto at the head of Edisto Island. Thence down the Edisto into St. Helena Sound, and from that sheet of water, either by Morgan and Port Royal river, or by Coosa and Broad rivers, into Port Royal Entrance. From the latter by the channels on the north side of Hilton Head Island and Calibogue Sound into the mouth of Savannah river.

In Armroyd's Internal Navigation, the navigable distance between the extremes of this line is stated at 100 miles, and the requisite canals to cut at most supposed 40; but the direct distance being 80 miles, it may be doubted whether a practicable line of river and canals could be carried from the port of Charleston into Savannah river, without its exceeding 100 miles.

The harbour of Charleston has been, since 1802, united to Santee river, by a canal from the head of Cooper river, N.N.W. 22 miles into Santee, opposite Black Oak Island. The canal is 34 feet wide, 4 feet deep, and cost 650,667 dollars.

The Santee, Columbia and Saluda navigation is carried above the Charleston canal, 150 miles, by a combined series of rivers and canals, with 28 locks to overcome 217 feet fall, and opens the commerce of much of the upper part of South Carolina to Charleston. The foregoing embraced only a part of the basin of Santee; as it did not reach its longest branch, the Wateree and confluents. Extensive side cuts have been completed on the latter in Kershaw district above Camden, at Rocky Mount, in the north-east part of Fairfield district, and at other places on the Wateree and constituent streams.

What has been noticed, embraces that part of the navigation of the physical section represented by Table V., and of which a part of the artificial improvements had been actually formed. In addition, however, to the foregoing, it has been suggested to extend canal or sluice improvement to the most mountainous districts watered by the Seneca, and the higher branches of Saluda, Pacolet, Broad, Catawba, and Yadkin rivers.

In their plans of inland navigation, the people of South Carolina have not neglected rail roads. Considerable advance has been made in the construction of such a road from the city of Charleston to the Savannah river at Hamburg and Augusta. A charter was granted for the purpose to a company styled "The South Carolina Canal and Rail Road Company." The distance about 130 miles, in a direction of north-west by west. A branch road is to leave the main line at Orangeburg, and be carried, a little W. of N., about 40 miles to Columbia.

On a section of the earth differing so greatly in its extreme features, no one system of improvement could be effectually adopted. The whole embracing a vast inclined plain with a general north-western direction 250 miles, and rising from tide level to at least a mean of 1500 feet. The interior apex, a chain of mountains from which the streams meander by very tortuous channels, and reach their oceanic recipient over a marshy and in great part flat and diurnally inundated border. Along the ocean coast and for 60 or 70 miles, inland canals are the most practicable, and in many localities the only practicable melioration that art can effect on the face of nature; but receding towards the mountains the same exclusive preference is finally given or perhaps ought to be given to roads. A remark may be made on the rivers included in Table V., which, with some limitation, is due to all the streams issuing from the Atlantic side of the Appalachian system. It is, that their volumes of water are more abundant and more durable at each extreme than in the middle part of their courses. This will be more illustrated in the sequel, and may be dismissed here with the observation, that the causes of the phenomenon are no doubt evaporation and absorption, the former more especially.

With Georgetown entrance, or the mouth of Pedee, commences a new character of coast. The productive and comparatively small protruding islands which skirt Georgia and South Carolina cease, and from Winyaw Point to Cape Fear, the coast sweeeps inward an elliptical curve bounding Long Bay, by a low sandy line a little exceeding 100 miles. The small islands are mere sandy reefs lying parallel to the coast; and the inlets, so excessively numerous from the mouth of the Alatamaha to that of the Pedee, now become rare. Long Bay is followed by two others of nearly equal length, and in a very remarkable manner similar in regard to their inland curves and the features of their shores. Onslow Bay extends a semi-ellipsis from Cape Fear to Cape Lookout, and Raleigh Bay from Cape Lookout to Cape Hatteras. The latter promontory, the terror of mariners, and the great salient angle of the basin of North Carolina, projects into the Atlantic Ocean at N. Lat. 35° 12′, and Lon. 1° 36′ E. from W.C. The general bearing of this singular series of curves on the Atlantic coast of the United States, from the mouth of Pedee, or more precisely, from Winyaw Point to Cape Hatteras is, by calculation on Mercator's principles, N. 57° 35′ E. and the reverse, and the distance 291½ statute miles.

With Cape Hatteras the coast, maintaining its character of long low sand islands extending parallel to the margin of the ocean, inflects 70 degrees, and stretches in an almost direct line of 130 statute miles to Cape Henry, at the mouth of Chesapeake Bay. Combining the two lines of coast on each side of Cape Hatteras, we have, from Winyaw Bay to that of Chesapeake, a sandy coast of 421 statute miles, enclosing a physical section drained by Cape Fear river, Neuse river, Pamtico or Tar river, Roanoke, and Chowan rivers. This section may be with propriety designated the basin of North Carolina, since, though the larger part of the subbasin of its principal stream, the Roanoke, is in Virginia, it is discharged with all its confluents into the ocean on the North Carolina coast. In their aggregate forms, as regard the range of their individual rivers, the two basins of Georgia and South Carolina, and that of North Carolina, present a marked contrast. In the basin of Georgia and South Carolina, the sources of the rivers spread 350 miles along the Atlantic side of the Blue Ridge, like the branches of a tree; whilst their volumes gradually approach and meet their common recipient within extremes of 200 miles. On the contrary, the basin of North Carolina spreads like a fan along the Atlantic Ocean, with an immense salient curve from Little River inlet to the head of North river, a confluent of Currituck Sound, with a chord of 270 miles, whilst the remote sources of its rivers are restricted to about 90 miles along the Blue Ridge.

Cape Fear river, the largest stream which rises and has its entire basin in North Carolina, has its most remote source in the South East Mountain, between and overheaded by those of Yadkin and Dan river branch of Roanoke. Cape Fear river is formed by two confluents, Haw river and Deep river. Both rise on the south-eastern border of Stokes county, but Haw river derives the larger share of its higher streams from Guilford, Rockingham, and Orange counties; from which, flowing to the south-eastward, they unite in the latter, and entering Chatham join Deep river at Haywoodboro'. Deep river, from its highest fountains in Stokes, flows to the south-eastward over Guilford and Randolph into Moore county. Curving from the latter to N.E. by E. it enters Chatham, and, uniting with Haw river, the combined waters are thence known as Cape Fear river. Below Haywoodboro' the main volume of Cape Fear river, forming two great elliptical curves first to the eastward and secondly westward, and passing Fayetteville, Elizabeth, and Wilmington, falls into the Atlantic Ocean almost exactly on the intersection of N. Lat. 34° and Lon. 1° W. from W.C.

The general course of Haw river is continued in the main volume, and the range of the basin is very nearly from N.W. to S.E.; length 200 miles. Where broadest, the width falls short of 70; and is fully estimated by a mean of 40 miles; or the area is about 8000 square miles. This basin extends in Lat. from 34° to 36° 22′, and in Lon. from 0° 40′ to 3° 08′ W. from W.C.

From the right, below the junction of Haw and Deep rivers, the main volume of Cape Fear river receives no tributary above the size of a large creek, and on the left also, the confluents are few and limited in length, until a short distance above Wilmington, enter in rapid succession, South river and North Branch of Cape Fear river. In either volume or length of course, those two minor branches would not deserve specific notice, but from their relative position they derive great importance amongst the natural channels which may be made subservient to canal improvement.

South river, or Black river, as it is called in the higher part of its course, rises in Cumberland and Johnson counties, within 10 or 12 miles from the main volume of Neuse river, and flowing thence S.S.E. almost parallel to Cape Fear river, and receiving large accessions of water from Sampson county, it falls into Cape Fear river, between Brunswick and New Hanover counties, and in a direct line 28 miles above the mouth of the main stream.

North Branch of Cape Fear river has the extreme source in Wayne county, within three miles from the right bank of Neuse river, from whence it pursues very nearly a southern comparative course of about 70 miles, to where it falls into Cape Fear river at Wilmington, having traversed Duplin and New Hanover counties.

Pamtico, the first advancing from the south and the most extensive of the two great sounds of North Carolina, is the estuary or common recipient of two rivers, Neuse to the south-west, and Tar river to the north-east. Both Neuse and Tar rivers derive their sources below the South East Mountain, and in Person county, North Carolina. Neuse river, leaving Person and traversing Orange, Wake, and Johnson, and passing Raleigh the capital of the State, pursues a comparative south-eastern course of 100 miles to Waynesboro, in Wayne county. About twenty miles above the latter place, the main volumes of Neuse and Cape Fear rivers approach within 25 miles of each other, approaching by counter curves, and then rapidly receding. Below Waynesboro, with a southern curve, the course of the Neuse is nearly east 40 miles, to where it receives a large tributary branch, Contentney creek, on the border between Craven and Pitt counties; bending thence to south-east 40 miles, it widens into a bay, which, inflecting to north-east another 40 miles, is lost in the wider expanse of Pamtico Sound. The entire valley of Neuse lies in a direction of S.E. by E. and the reverse. Length 180, mean breadth 40, and area 7200 square miles.

Tar river rises in Person, but flowing thence traverses Granville and Franklin, and to the central part of Nash county, 65 miles, by a comparative course. Inflecting to a little north of east 30 miles receives a large augmentation of volume from the influx of Sandy and Fishing creeks in Edgecomb county. Fishing and Sandy creeks drain the space between Tar river and the Roanoke, and the sources of the former approach very near the actual margin of the Roanoke. Immediately below the union of its main branches, the volume of Tar river passes Tarboro, and sweeping a large southern curve, but by a general south-eastern course of 40 miles, reaches Washington in Pitt county, below which latter place, widening into a bay of 40 miles in a south-eastern direction, the water is lost in Pamtico Sound.

The basin of Tar river is 160 miles in length by 25 mean width, area 4000 square miles. Extending in Lat. from 35° 15′ to 36° 25′, and in Lon. from 0° to 30′ E. to 1° 50′ W. from W.C.

If taken into one view, and including in it the narrow slope of Onslow, between Cape Fear and Neuse rivers, and Pamtico Sound, the basin of Pamtico will reach from Cape Hatteras to the source of Neuse river, 230 miles; mean breadth about 60, and area 13,800 square miles. Of this space, however, Pamtico Sound and its minor bays occupy 1800 square miles, leaving to the land surface 12,000 square miles.

Roanoke or Albemarle basin follows and bounds on the Yadkin, Cape Fear, and both sub-basins of Pamtico. The Roanoke is the first Atlantic river which, advancing from the south-westward, derives its remote sources from the interior of the Blue Ridge. This stream has its most distant fountains in Montgomery county, Virginia, at an elevation of about 2200 feet above the Atlantic tides, and within eight miles from the main channel of New river, with the Kittatinny chain intervening. From this comparatively elevated origin, and deriving confluent water from numerous creeks from the valley between the Blue Ridge and Kittatinny, and between the sources of Little river branch of New river and those of James river, Roanoke flows north-eastward 20 miles to Salem in Botetourt county, having already fallen upwards of 1200 feet. The water level at Salem is by actual admeasurement 1002 feet above the level of the Atlantic Ocean. Below Salem, the main stream bends to eastward 20 miles to its passage through Blue Ridge. Below Blue Ridge the Roanoke flows to the south-eastward 25 miles, receiving the entire drain of that part of the valley between Blue Ridge and South East Mountain which is occupied by Franklin county. Passing South East Mountain, between Bedford and Pittsylvania counties, the now considerable volume sweeps by an elongated elliptical curve to the north, and round to S.E., but by a general course of south-east by east 50 miles to the influx of Dan river from the west.

Dan river, very little inferior in volume or length of course to the Roanoke, rises in the valley between the Blue Ridge and South East Mountain, interlocking sources on the south with the Yadkin, and on the north with the Franklin county branches of Roanoke, and opposite to the eastern confluents of New river. Pursuing a general comparative course of 110 miles, and draining the northern parts of Stokes, Rockingham, Caswell, Person, and Granville counties, North Carolina, with all Patrick and Henry, and great part of Pittsylvania and Halifax counties, in Virginia, Dan river joins the Roanoke in the western side of Mecklenburg county. Below their junction, the united waters pursue a direction a little south of east, sixty miles, to the lower falls and head of tide water, at Weldon, having, at about midway between the mouth of Dan and Weldon, passed from Virginia into North Carolina. Having met the tides, the Roanoke, by a very tortuous channel, assumes a south-eastern comparative course of 50 miles, and thence eastward 25 miles, to its junction with Chowan river, at the head of Albemarle Sound.

The entire valley of Roanoke, by either the main stream or Dan river, is about 250 miles comparative course, but the channel is a greater length. By comparative courses, it is only 155 miles from Salem to the falls at Weldon, whilst, by authority of a report made to the Roanoke Company, the intermediate actual channel is 244 miles. From the preceding proportions, the real windings of this river amount to near four hundred miles.

That part of the basin of Roanoke comprising the valleys of that stream and Dan river, above their junction, is 110 miles from east to west, with a mean width of 60, or 6600 square miles. The lower part of the basin is very narrow, as, in a direct distance of 125 miles from the mouth of Dan river to the head of Albemarle Sound, the mean width can hardly be stated at 15 miles, area 1875 square miles. Taking the whole surface into one view, the area amounts to 8475 square miles, mean breadth 37, very nearly.

Chowan river enters the head of Albemarle Sound to the north of the mouth of Roanoke, and is itself formed by two branches, the Meheren and Nottaway. The Meheren, or south-western branch, rises in Mecklenburg, Charlotte, and Lunenburg counties, Virginia, interlocking sources with those of Nottaway, Appamattox, and some small confluents of Roanoke. The comparative length is about 100 miles in a direction of south-east by east; 18 or 20 miles of the lowest part of its channel in North Carolina.

The united waters of Nottaway Proper and Blackwater form a considerably larger stream than the Meheren. The extreme sources of Nottaway are in Prince Edward county, Virginia, between those of Meheren and Appamattox. Flowing thence, by comparative distance, seventy miles, in a direction very little S. of E. and draining, on the left, a part of Nottaway, Dinwiddie, Prince George, and Sussex counties, and, from the right, part of Lunenburg, Brunswick, Greeneville, and Sussex. At very near the centre of the latter county, the Nottaway inflects to south-east, and continues that direction 40 miles, to its junction with Blackwater, almost exactly on the line between Virginia and North Carolina.

The Blackwater is one of those rivers of the Atlantic slope of the United States, which appears to have been formed by nature to facilitate the construction of an inland line of canal navigation. This stream rises in Prince George county, and very near the junction of Appamattox with James river. Flowing thence southeastward 40 miles, by comparative courses, between Surry and Sussex, and between Southampton and Isle of Wight, it thence bends to nearly due south, 30 miles, to its union with Nottaway. The latter, below the influx of Blackwater, flows about eight miles a little west of south, to its junction with the Meheren, to form Chowan river. The course of the Meheren is preserved by the united waters for twenty miles, between Hertford and Gates counties, and thence gradually opening into a bay which extends a little east of south, 25 miles, to the mouth of Roanoke.

The entire sub-basin of Chowan is about 125 miles in length, and where widest 60 miles; but the mean breadth about 30 miles; area 3750 square miles.

Included in the great basin of Albemarle, and drained directly into Albemarle Sound, are two slopes, with very slight descent; the one to the southward from the sound is drained by the outlet of Lake Phelps and Alligator river; and the opposite by Perquimans, Pasquotank, North river, and some other smaller inlets. The southern slope embraces the northern and larger section of that flat and inundated peninsula between Pamtico and Albemarle Sounds; and the opposing plain of similar natural features, comprises the southern part of the peninsula between the Atlantic Ocean, Chesapeake Bay, James, Blackwater, and Chowan rivers and Albemarle Sound. This lower section of Albemarle Basin, including the intermediate sound and bays, is 80 miles long from north to south, with a mean breadth of 60; area 4800 square miles.

From the eastern extremity of Albemarle Sound to the head branch of Roanoke is 290 miles, in a direction from S.E. by E. to N.W. by W. The mean breadth of the basin is within a small fraction of 58 miles; aggregate area 17,000 square miles very nearly. Extending in Lat. from 35° 30′ to 37° 25′ North, and in Lon. from 1° 30′ E. to 3° 24′ W. from W.C.

Embracing the entire basin of Albemarle, it presents at once a physical section and a physical limit. If we reject the elevated valley from which the remote sources of Roanoke are derived, the difference of level is about 1000 feet, or an equivalent for 2½ degrees of latitude in mean temperature.

TABLE VI.

Summary of the North Carolina Basin.

Sub-Basins.	Length.	Mean Breadth	Area in Square Miles.	Between Latitudes North Lat.		Between Longitudes	
Cape Fear R.	200	40	8000	34°00′	36°22′	0°40′	3°08 W.
Neuse,	180	40	7200	34 50	36 22	1 00 E.	2 15 W.
Tar River,	160	25	4000	35 15	36 25	0 30 E.	1 50 W.
Albemarle, Sub-Basin,	290	58½	17,000	35 30	37 25	1 30 E. 1 30 E.	3 2 3 24 W.
Aggregate,	310	117	36,200	34 00	37 25	1 30 E.	3 24 W.
To which add Basin of Geo & S. Carolina,	380	170	64,600	31 15	36 35	2 10	7 20 W.
Aggregate,	510	200	100,800	31 15	37 25	1 30 E.	7 20 W.

Exclusive of the peninsula of Florida, which forms another and very distinct natural section, we have, from the Alatamaha to the Roanoke and Chowan inclusive, a great physical section exceeding one hundred thousand square miles, and embracing within its extremes a small fraction above six degrees of latitude, and rising from the level of the ocean to upwards of two thousand feet. If the effect of relative height is therefore taken into the estimate, this region comprises fully the extremes of ten degrees of latitude on its mean and extreme temperature. The winter climate on the high vallies drained by the sources of New river, Yadkin, Roanoke, and James river, assimilates to that on the Atlantic coast at latitude 41° or 42° north. This subject will be more particularly and more appropriately noticed under the head of Climate. We proceed to review the commercial connexion of the North Carolina basin, with those on each land side.

Without possessing a previous knowledge of the depth of water, a glance on a map of North Carolina would suggest the idea, that the Atlantic section was from nature peculiarly fitted for inland navigation; but a survey of the sounds and small bays discloses the fact, that a depth of seven feet is the utmost that can be calculated on; and further, that the sub-basins of Albemarle and Pamtico, so far from offering greater facilities, oppose very formidable physical difficulties against connecting the Chesapeake and Cape Fear basins by a line of mixed river and canal navigation.

The basins of Albemarle and Chesapeake are separated by an almost dead level and marshy peninsula of sixty miles width, and bisected into two very nearly equal sections by the line of demarcation between North Carolina and Virginia. The geographical position of this peninsula may be particularly remembered by the facts, that north latitude 36° passes nearly along the middle of Albemarle Sound, and 37° enters centrically into the mouth of Chesapeake Bay. The character of this tract is given by the name imposed on its central part. "The Dismal Swamp" is a name and a description. From this dreary waste of lakes, swamps, and tangled woods, are discharged Bennet's creek southwardly into Chowan river; and south-eastwardly, Perquimans, Pasquotank, and North river, into Albemarle Sound. On the opposite side Nansemond and Elizabeth rivers carry the surplus water into Hampton Roads, or the mouth of James river. Along the ocean, Currituck Sound extends fifty miles northwardly from that of Albemarle, separated from the ocean by only a long, narrow, and low reef of sand. The extreme northern part of Currituck Sound approaches to within ten miles of tide water in Lynnhaven Bay. The space, indeed, between the northern end of Currituck Sound and Cape Henry is a continuation of the sand reef stretching from Cape Hatteras to Chesapeake Bay. It may be remarked, that in a distance of 128 miles northward from Cape Hatteras to Chesapeake Bay, the reef has but three openings, New Inlet, South Inlet, and Currituck Inlet; and again south-westward from Cape Hatteras to the mouth of Cape Fear river, though there are numerous small inlets through the reef, there is but three or four of any commercial or naval importance. Ocracoke Inlet, Cedar Inlet, the pass into Beaufort, and New river Inlet, are the deepest along the south-eastern coast of the great basin of North Carolina. The impracticable nature of this coast, of upwards of three hundred miles, with interior waters no where admitting more than seven feet water, except at the harbour of Beaufort, may be still more strongly depicted by the fewness of inlets. Seventy miles occurring in one place, having Cape Hatteras near the middle point, without a single pass from the ocean to the interior.

The first successful attempt to form any artificial improvement on the navigable channels of this region of shallows, led to the completion of the Dismal Swamp Canal. This canal of intercommunication between the basins of North Carolina and Virginia was navigated, and produced tolls as early as 1822. It commences on Deep creek, a branch of Elizabeth river, and extends through Dismal Swamp to Joyce's creek, a confluent of Pasquotank. It is in length 23 miles, and rises $16\frac{1}{2}$ feet above the Atlantic level; 40 feet wide at top, with $6\frac{1}{2}$ feet water; it is connected with Lake Drummond by a feeder of five miles in length and $4\frac{1}{2}$ feet water.

Since the original plan of the Dismal Swamp Canal was partially carried into effect, it was suggested to give it a depth of eight or ten feet water, to render its capacity adequate to receive any vessel which could pass the Chesapeake and Delaware Canal; but the shallowness of the southern sounds restricted their navigation to vessels drawing seven feet water at most, and therefore unless the Dismal Swamp Canal could have been followed by a line of equal depth, it was useless to give it a greater depth than requisite for the coasting trade of North Carolina.

A line of canals and river navigation has, however, been proposed, which will, no doubt, with modifications to suit local circumstances, be in time effected. This great plan is to commence with, and both widen and deepen, the Dismal Swamp Canal, and, in place of debouching in Pasquotank river, carry it into Chowan river, at or near the mouth of Bennet's creek, and thence down the channel, or along the bank of Chowan, to its junction with the Roanoke, and on to Plymouth, and up the Roanoke to the port of Williamston. From the latter point it is 21 or 22 miles nearly due south to Washington on Tar or Pamtico river. From Washington, again, it is only 16 miles, also in a southern direction, to the navigable waters of Neuse river, in Swift creek, at Dawson's Bridge. From Dawson's Bridge, a natural channel of 35 miles down Neuse river, past Newbern, leads to the great bend of Neuse Bay, and to Adams creek. Thence up the latter, which affords 12 feet water, and, by an intermediate canal of three miles, to North river, down which, by good navigation, to Beaufort. The whole of this line of from 180 to 200 miles, of which at least 70 would be by natural channels, would receive the influx of Chowan, Roanoke, Tar, and Neuse rivers, and, as may be seen by reference to Table VI., would be supported by the productive labour of the inhabitants of upwards of 56,000 square miles.

By a report made to the congress of the United States, 9th March, 1826, by the Engineer Department, through the secretary of war, this, or very nearly a similar route from Norfolk to Beaufort, is strongly recommended; but, from the tenor of the report, it is evident the framers had Beaufort harbour constantly in view, as the southern termination, and such a line would, no doubt, be a work worthy of a nation, but is demonstratively only a part of what is necessary and practicable to unite the deep bay of Chesapeake with the basins of South Carolina and Georgia. Any canal carried, as proposed, into Neuse river, by Swift creek, could be continued up that stream to its great bend, in Lenoir county, and thence into the North branch of Cape Fear river; or could leave the Neuse at Newbern, and follow the Trent into Duplin; and thence into the North branch of Cape Fear river; following either of the latter routes, and down the North branch, would enter Cape Fear river at Wilmington.

Cape Fear river itself, from the relative position of its basin, and the course of its channel, comparatively with those of the Neuse to the north-eastward, and Great Pedee to the west and south-westward, is a region of great interest. In our description of the basin of Pedee, it may be seen how very near the main volume of Cape Fear river approaches the sources of Waccamaw and Little Pedee, and with how little comparative expense a canal could be made from the basin of Cape Fear river into that of Pedee. The canal and river improvements southward from Pedee basin inclusive, have been noticed under the heads summed in Table V. We now proceed to review the canal and road improvements in the North Carolina basin.

The rendering even partially navigable the sounds along the lower part of the basin of North Carolina, were such a work practicable, would do honour to a nation; but there is one alternative too often lost sight of in projects of every kind in the United States, and that is, "*Is this work the most eligible to effect the purpose intended?*" By an act of Congress, the 20th of May 1826, it was required, that "a survey be made of Roanoke Inlet and Sound (Albemarle), with a view to ascertaining as to the practicability of making a permanent ship channel between Albemarle Sound and the Atlantic Ocean, at Roanoke Inlet." The prefatory remarks of a report made in virtue of the required survey, as quoted in Armroyd's Internal Navigation of the United States, contains more than a doubt of attaining the object. "It is impossible," states the report, "to enter upon the discussion of the proposed project, involving such important consequences to the populous and productive portions of the country watered by the Roanoke river, without feeling deeply sensible of the difficulties in effecting so desirable an object, and the degree of uncertainty attending the result of any operations where the causes to be governed are so infinite and powerful. Wherever the course of nature, in her marine operations, is to be governed, there is probably no subject within the range of the science where so much is deduced from hypothesis, and where, necessarily, in the result, there is so little certainty."

It demands no abstract reasoning to determine the preference, where the object in view is the same, between an intended work, where "*Nature, in her marine operations, is to be governed,*" and another placed beyond the reach of so uncontrollable an agent as an ocean. There is, perhaps, no other contrast more striking than to see the volume of water in a canal so completely under the control of man; and yet performing operations beyond all human force, and the utterly ungovernable mass of water rolling to and from an ocean coast.

It would, indeed, be most desirable, if practicable, to find a situation admitting a good harbour, if only of 15 or 20 feet depth, between Charleston harbour and the mouth of Chesapeake Bay; but leaving the hypothesis where it was left by the United States engineers, we proceed to investigate what has been performed and planned to improve the inland navigable channels in the North Carolina basin.

About North Lat. 35° 50′, at a place called Nag's Head, 45 or 46 miles along the reef to the northward from Cape Hatteras, it appears there formerly existed an inlet with 10 feet water, which has long been closed by oceanic deposit. This, when open, was called Roanoke Inlet, and was directly outside of Roanoke Island and the two straits uniting Pamtico to Albemarle Sound. The same powerful agent which closed Roanoke Inlet opened New Inlet, opposite the north-east part of Pamtico Sound, and 30 miles northwardly from Cape Hatteras.

Conflicting plans have been proposed to meliorate the navigable facilities of this coast. One was, that under the influence of which the Act of Congress of the 20th May 1826 was passed, and which has been already, together with its object, stated under this head. To carry such a project into effect, the engineer recommended to cut off all connexion between Albemarle and Pamtico Sounds by mole or embankments across Croatan and Roanoke Sounds or straits, and to make a new passage or inlet by dredging. The engineer then submitted two plans of execution:

Estimate for stone embankments,	$2,363,483
do. of timber and earth do.	1,206,297.

The engineer in closing his report throws doubts on the practicable execution and preservation of such works, exposed to the winds and waves of the Atlantic Ocean, and farther, "not still perceiving a great probability that the country could, in consequence, be benefited in its intercourse, and home and foreign trade, to an extent that would counterbalance the heavy expense involved in erecting and maintaining the needful works: but especially dubious as to the possibility of guarding the proposed usefulness of them against future encroachments or accidents of impediment, induced by an unsettled ocean."

To this we may add, that if the proposed inlet was successfully completed, and its eventual deterioration by the action of the Atlantic Ocean guarded against to full security, the embankment over the two straits on each side of Roanoke island would put a total stoppage to water intercommunication between the two extremes of the North Carolina basin, by its two principal Sounds, and render more necessary the existence of a counter canal across the general course of the rivers, and to the interior of the Sounds. The state engineer himself doubting, however, either the easy execution and preservation of such a work on the ocean border, or its extensive benefits if in existence, presents another plan in the following terms:

"The general features of the plan now presented for consideration are, the excavation of a channel through the shoal ground in the sound, cutting across the sands between it and the sea, and, by the intervention of a tide lock, secure to the trade an outward navigation at all times, between half tide and high water. In submitting this plan, we must regret the entire impracticability of giving to the import trade the benefits of the same channel. This will be evident at once in the smallness of the sea mouth of the cut, thereby causing great risk in attempting its entrance, with a lee shore, as it must always prove—and in the immediate vicinity of a cape, the most dangerous, with one exception, of our extended coast, without the protection of a breakwater, in case of unfavourable weather. The hopelessness of combining such an auxiliary, however, is most conclusive, when we reflect upon the unremitting tendency of the currents of the ocean on the southern coast, and the abundance of the elements which go into the formation of the shoals, and which, in this instance, would endanger the safety, if not, indeed, the very existence of the proposed inlet."

The defects of this plan are candidly stated, but the engineer proceeds to dwell upon the greater cheapness of execution and security for the works when completed. He gives the aggregate of $327,734 10, as the necessary expenditure.

The Roanoke Inlet Company was created by Act of Assembly of North Carolina, 1821.

The labours of that state, however, both in and out of its legislature, have had more direct and effective success when expended upon the rivers within, than when employed to form channels through the sounds. No one river of North Carolina has nevertheless yet been rendered as navigable, even along its channel, as the volume of water and moderate requisite expense would admit.

Cape Fear river channel, so important to some of the best cultivated counties of the state, has been partially improved. The Board of Internal Improvement, on the 22d of January 1827, reported to the legislature, that the improvement of the channel of Cape Fear river, from Wilmington to Fayetteville, had been prosecuted the preceding year to considerable extent, but that much then remained to do in clearing the channel even as high as Black or South river. The sluicing system was recommended, and also a dam and locks at Smiley's Falls; and by combining the different kinds of improvement, obtain a steam-boat navigation from Wilmington to Fayetteville, during ten months of the year; and a batteaux navigation thence to Haywoodsboro, in Chatham county, at the junction of Haw and Deep rivers: entire distance by the channel from Wilmington to Haywoodsboro, 180 miles.

The preceding improvements would be connected with those of the Yadkin, if another projected route was carried into effect. The lower part of the channel of Deep river, the western constituent of Cape Fear river, extends about 30 miles, or nearly half the intermediate distance, directly towards the Yadkin, below the Narrows in Montgomery county. A design of a canal has been conceived to leave Haywoodsboro, pursue the valley of Deep river as far as necessary, and thence by the most practicable route to the Yadkin, at or near Blakeley in the lower part of Montgomery county. This route has received the title of "Cape Fear and Pedee Canal," and would most certainly be, if actually and efficiently formed, a great link in the net work of internal improvement, but it is yet a project.

We have already noticed the works already executed and projected in the comparatively large basin of Pedee, but may here, in order to preserve connexion, turn our attention to the Upper Pedee or Yadkin.

The distance from Wilkes Court House to the point where the Cape Fear and Pedee Canal is intended to debouch into the Yadkin, is estimated at 200 miles. This distance it is designed to render navigable along the channel to the Narrows in Montgomery county, where a canal and locks are stated to be necessary, and where the side canal would connect with the Cape Fear and Pedee Canal. See our notice of Pedee basin, whilst we return to a review of the important basin of Roanoke.

The lower falls in Roanoke, between Northampton and Halifax counties, North Carolina, must at a future time form a separation between two species of navigation on that stream. These falls are formed by the passage of the river over the great outer ledge of the Appalachian system, and in a distance of 12 miles above Weldon, the water falls 100 feet. This descent is overcome by the Weldon canal.

Weldon is a village, port, and post town of Halifax county, North Carolina, situated at the foot of the Great Falls, very nearly mid-way between Raleigh and Norfolk in Virginia, and, by the road, 85 miles from each. Below Weldon the Roanoke is very tortuous in its course, the channel being estimated at 90 miles, though the comparative length is only about 70. This distance is navigated by sloops. Above Weldon the two states of North Carolina and Virginia have, by canals and other improvements, made the channel of Roanoke navigable for boats 244 miles to Salem in Botetourt county, Virginia. In the upper navigation, the sluicing system has been extensively employed.

The Dan river navigation, though in reality a branch of that of upper Roanoke, is given under a separate head in Armroyd's Internal Navigation of the United States. That author informs us, under head of Danville and Dan River Canals, that beside the important canal at Danville, the sluicing improvements extended, when the account was written, 152 miles above Rock Landing, and reached Leakesville in Rockingham county, North Carolina.

The expenditure of capital, up to November 1826, on all branches of the Roanoke navigation, made by the Roanoke Navigation Company, including, however, real estate and slaves held by the company, amounted to $341,283; and by similar estimates, up to the 5th Nov. 1828, the amount of expenditure and property held by the Company was $365,991.

The Weldon locks and canal unite the lower and higher navigation of this fine stream, the extent of which will be seen at a glance on the subjoined summary.

Roanoke sloop navigation below Weldon to the head of Albemarle Sound,	90	miles.
From head of Albemarle Sound to the Atlantic Ocean at South inlet, .	80	do.
Upper Roanoke, by the main channel, to Salem in Botetourt county, Virginia,	244	do.
Danville navigation, . . .	180	do.
Amount, . . .	594	

The canal line, designated "The Plymouth and Beaufort Canal," recommended by the Engineer Department of the United States, the 9th March 1826, has been already noticed, and deviations and enlargement recommended, under the present head. As an adjunct to these interlocking chains, another line was designed, called the Murfreesboro' Canal. This latter, as planned, is to leave the Weldon canal basin, or some other point near and above the basin, and be extended thence by a route, a little north of east, to Murfreesboro' on Meheren river; down the Meheren and Chowan to Bennett creek; and thence along the channel of the latter, and from it, by the most eligible route, into the Dismal Swamp Canal. The length necessary for the Murfreesboro' chain of canal and river navigation has been estimated at 80 miles; and the requisite sum to carry it into effect 761,522 dollars, as reported in 1818, by a joint Board of Commissioners of the states of North Carolina and Virginia.

The connexions of the Roanoke basin will be more developed under the succeeding head.

The Basin of Chesapeake. This most extensive river physical section of the Atlantic Slope of the United States, has the united basins of Chowan and Roanoke south; the north-eastern part of the basin of Mississippi, or the valley of Ohio west; the basin of Ontario, and the north-western part of that of Hudson north; valley of Schoharie north-east; Basin of Delaware, and the narrow Atlantic slope of the Eastern Shore of Maryland and Virginia east. The longest line that can be drawn within it extends in a direction very nearly from south-west to north-east, and from the extreme western sources of James river, in the Alleghany chain of mountains to those of the Unadilla branch of Susquehannah, within a small fraction of 500 miles. It is about 260 miles where widest, from east to west, and from the Eastern Shore of Virginia to the western sources of James river. The entire area being about 69,000 square miles, the mean breadth will be 138 miles nearly.

In latitude, this fine natural section of the earth extends from 36° 40′ to 42° 55′, and in Lon. from 2° 20′ E. to 3° 40′ W. from W. C.: consequently, it embraces 6¼ degrees of latitude and 6 degrees of longitude. Central latitude, 39° 47½′. If the Peaks of Otter are taken into view, the relative height is from the level of the ocean to 4200 feet elevation; but rejecting the mountain height and regarding only the declination of the rivers, the difference of height will be about 1500 feet.

Taken in its utmost extent, this basin sweeps entirely across the Appalachian system, and embraces at the fountains of Susquehannah, a part of the interior secondary formation, traverses obliquely over the transition and the primitive, and reaches the ocean by a border of recent sea-sand alluvion. The great features will appear more distinct by a survey of the sub-basins, to which we proceed, advancing from south to north.

James river is the southernmost confluent of Chesapeake Bay, deriving its most remote sources from the Alleghany chain opposite to those of Green Brier branch of Great Kenhawa; south from those of Shenandoah and other branches of Potomac; and north from some of the small confluents of New river, and from the higher sources of Roanoke. It is remarkable that the extreme source of Potts Creek, the most south-western constituent of James river, rises only seven or eight miles from the main channel of New river, upwards of 100 miles comparative course below the higher fountains of the latter.

It has been observed under the present head, but may be more distinctly seen by inspection of a general map of the United States, that the river channels from the Great Pedee, or Yadkin, to the north-eastward were gradually assuming general courses more to the eastward. This change has reached its utmost term in the channel of James river, beyond which, the rivers again curve more and more towards a southern course, and from the Susquehannah to Penobscot inclusive, all the main streams have a general course something west of due south. It may be also observed, as a general character of the Atlantic rivers of the United States, but most prominent in the basins of Chesapeake and Delaware, that, though uninfluenced as to their respective recipients, their intermediate courses are determined by the mountain chains. This mountain influence extends so far, that the main volumes of the Chesapeake and Delaware confluents are almost uniformly along the mountain vallies, or at right angles to the mountain chains and vallies.

These observations are exemplified in the higher branches of James river; the northern, James river Proper, Cowpasture and North river, rising in the same vallies with the sources of Shenandoah and Potomac, but flowing in an opposite direction or south-westward, and meeting the southern branches, Dunlap creek, Potts creek, Craig creek and Catawba. The main James river, or, as there called, Jackson river, rises in Pendleton county, Virginia, and in the mountain valley east from the Alleghany chain; and flowing thence by comparative courses 50 miles, receives Dunlap creek, inflects to the southward 4 or 5 miles, traverses a minor chain of mountains, passes Covington, receives Potts creek, and rapidly bends to the north-eastward, 12 miles to its junction with Cowpasture river. The latter, a considerable branch, has the remote Pendleton, but similar, it flows south-westward over Bath into Alleghany, uniting with Jackson river at the north-western side of what is there called Potts' chain. Here the united waters take the name of James river, bend to south-eastward 25 miles by comparative course, traversing several chains of mountains into the valley between Blue Ridge and Kittatinny. Again inflecting to north-east 16 or 17 miles, receives North river from Augusta and Rockbridge counties, rapidly again bends to the south-east, and piercing the Blue Ridge, enters on the fine valley between the latter chain and South East Mountain, and flowing 25 miles, traverses this lower distinct chain of the Appalachian system near Lynchburg, and between Amherst and Campbell counties. Once more this now considerable stream bends to north-eastward, and flows in that direction about 40 miles, and in that part of its channel almost completely parallel to the Blue Ridge, distant from 20 to 22 miles from that chain, and nearly along the south-eastern foot of the South East Mountain. Below the latter chain James river assumes its final course of south-east by east, which, with a very tortuous channel, it maintains by comparative length 70 miles, to the head of tide water at Richmond, and about 80 from thence to its entrance into Chesapeake bay, between points Willoughby and Old Point Comfort. James river is remarkable for the great number of small confluents, and receiving below Blue Ridge but two streams really deserving the name of rivers. Rivanna, rising by numerous branches from the Blue

Ridge opposite the sources of the South Fork of Shenandoah, is a fine stream of about 45 miles comparative length, draining great part of Albemarle and Fluvanna counties, and falling into the left side of James river, 59 miles, by the actual channel above tide water at Richmond.

Appomattox is the principal confluent of James river, either above or below the mountains. This stream rises in Prince Edward, Buckingham and Cumberland counties, interlocking sources with those of some minor confluents of James and Roanoke, and also with the higher branches of Nottaway. The intermediate windings and actual channel of Appomattox are very tortuous, and may exceed 130 miles, but the comparative length is about 85; 75 above tide water at Petersburg, and 10 below that city to its entrance into James river.

The valley or sub-basin of James river lies in a position inclining a few degrees to the north of west and south of east, in length 250 miles; mean breadth 40, and area 10,000 square miles. Extending in Lat. from 36° 40′ to 38° 20′ N.; and in Lon. from 1° E. to 3° 40′ W. from W.C.

For the relative elevations see Tables at the end of this head.

York river sub-basin, is overheaded by the interlocking sources of Rivanna branch of James river, and the Rapidan branch of Rappahannoc; the two latter originating in Blue Ridge, whilst the extreme fountains of the former are in the South East Mountain. York river is formed by two confluents, Pamunky to the south, and Mattapony to the north. The Pamunky is the main branch, and rises in Orange and Louisa counties, by numerous creeks, which enter and unite in Hanover near the head of tide water, below which it flows by a very crooked channel, but comparative distance of 40 miles, to its union with the Mattapony, having an entire comparative course of 90 miles S.E. by E.

The Mattapony rises in Spottsylvania county to the south-westward from Fredericksburg, from which, without receiving any accessory stream of consequence, it flows to the south-east 70 miles, between the Pamunky and Rappahannoc to its junction with the former, below which the united waters are known as York river.

The name of York river is really confined to a narrow bay of about 35 miles in length, extending from south-east to north-west, with, however, depth of water at its mouth for ships of the line of the largest class. The entire sub-basin of York river extends in length 130 miles, in a direction nearly from south-east to north-west; the mean breadth does not exceed 20, nor does the extreme width in any place amount to 40; area, 2600 square miles. Extending in Lat. from 37° 15′ to 38° 16′, and in Lon. from 0° 41′ E. to 1° 12′ W. from W.C.

The Rappahannoc basin or sub-basin follows that of York, but as already noticed the former extends to Blue Ridge. The Rappahannoc has been compared to a high tree with a small head and long trunk. The head is formed by two branches, Rapid Ann and North Fork, or Hedgman river. Rapid Ann rises in the south-eastern vales of Blue Ridge, opposite to the South Fork of Shenandoah, and interlocking sources on one side with those of Rivanna, and on the other with those of Hedgman river, draining Madison and Orange counties, and separating Culpepper from Orange and Spottsylvania counties, joins Hedgman river after an easterly course of 50 miles. The North Fork, or Hedgman river, rises in the Blue Ridge to the northward from the sources of Rapid Ann, and draining the greatest part of Fauquier and Culpepper, pursues a south-eastern course of 50 miles to its junction with Rapid Ann, to form the Rappahannoc. This stream, 10 or 12 miles below the union of its two main constituent branches, falls over the primitive ledge and meets the ocean tides at Fredericksburg. The Rappahannoc at the head of its tides is within 10 miles from the Potomac, at the great bend of the latter between Charles county in Maryland and Stafford in Virginia; and again, 15 or 16 miles lower the two rivers approach each other to within 5 or 6 miles. Below those points of approximation, in a distance of 75 miles, the intervening peninsula between the two streams is in no place 22 miles wide, and varying from that to 5 or 6 miles in breadth. Below the head of tide water, the channel of the Rappahannoc extends 90 miles in a direction from north-west to south-east, and similar to all the confluents of the Chesapeake gradually opens into a bay, and unites with its recipient by a mouth of 6 miles between Stingray and Windmill Point. In all the space from the head of the tides to Chesapeake, Rappahannoc does not receive from either side a confluent above the size of an ordinary creek, nor does that part of its basin exceed 12 miles in mean width. The entire basin extends from north-west to south-east 140 miles, with a mean width of 20 miles; area 2800 square miles. Extending in Lat. from 37° 34′ to 38° 44′, and in Lon. 0° 41′ E. to 1° 22′ W. from W.C.

The whole aggregate surface of the three sub-basins of James, York and Rappahannoc, are comprised in Virginia, of which political section they constitute the south-eastern, lowest, and warmest part, if we except a small section of James river basin above Blue Ridge. This comparatively tropical physical section of Virginia is followed by the important basin of Potomac, which forms connexions physically and politically deserving of more attention than the limits of this head will admit. The Potomac derives the far greater part of its water above the Blue Ridge, and the passage of its volume through that chain constitutes so striking a point of division, as to justify separating in description the two sections of the basin.

Potomac, above the Blue Ridge, is formed by the North Branch or Potomac Proper, Patterson South Branch, Cacapon, Back creek, Opequan and Shenandoah rivers, from the south-west, and a series of comparatively small confluents from the north. The stream to which the distinctive name of Potomac has been given, rises in the Alleghany chain opposite to the sources of Cheat and Youghiogany, N. Lat. 39° 10′, and Lon. 2° 30′ W. from W.C.; and flowing about 30 miles to the north-eastward, receives Savage river from the north, and inflecting to the south of east, in a distance of 10 miles, traverses one or two minor chains, and resuming a north-eastern course of 18 miles receives Wills creek at the town of Cumberland. The Potomac fed by mountain torrents, has at the influx of Wills creek become a river of considerable volume, and again breaking through two mountain chains in rapid succession, through which the channel is so tortuous, that in one place the course is turned backwards to south-west, but quickly winding round to a course of a few degrees south of east, unites with the South Branch by comparative courses, 15 miles below Cumberland.

What is called the South Branch, is the real and main Potomac, having its remote source in Pendleton county, Virginia, as far south as Lat. 38° 22′. The numerous mountain streams which, by their final union form the South Branch, originate in the mountain vallies, between the Kittatinny and Alleghany chains, and from thence by a general course of north-east, they unite near Morefield, in Hardy county, and also near the intersection of N. Lat. 39° and 2° W. Lon. from W.C. Below the union of its principal constituents, the South Branch, without receiving much additional water, continues its north-eastern course over Hardy and Hampshire counties, 40 miles to its union with Potomac. The enlarged volume formed by both streams, traverses a mountain chain immediately below their junction, and again winding round to a course of north-east, continues that direction by a very crooked channel, but comparative distance of 25 miles, to Hancocks town in Washington county, Maryland, having received several creeks from the north, and beside some others of less consequence, Great Cacapon from the south. At Hancockstown the channel of Potomac has reached its extreme northern point, N. Lat. 39° 41′ nearly, and less than two direct miles from the southern boundary of Pennsylvania; but again inflecting to a course of S.S.E. 20 miles to the influx of Conecocheague, from the north, having traversed the Kittatinny and entered the fine valley between that chain and the Blue Ridge. Below the mouth of Conecocheague, the course is west of south 5 or 6 miles to the influx of Opequan river from Frederick, Berkeley and Jefferson counties, Virginia, but having received the latter stream, the Potomac bends to a general course of S.S.E., 20 miles to its junction with the Shenandoah, and passes through the Blue Ridge at Harper's Ferry.

The real length of the channel of Potomac will be shown partially in the subjoined tables, but it may be observed here, that in order to preserve consistency between the actual area drained, and the channel, only the general length can be expressed in the verbal description.

Shenandoah brings to the Potomac little less volume than the main stream above their union. The former rises in the Kittatinny valley, as far south as 37° 55′, and in the southern angle of Augusta county, Virginia, two degrees W. of the meridian of W.C., interlocking sources with the North, or Great Calf Pasture Branch of James river, and on the opposite side of Blue Ridge from the sources of Rivanna. The entire valley of Shenandoah is comprised within and forms a part of the great Kittatinny valley. The main stream is formed by two branches, which, taken together, drain the far greater part of Augusta, all Rockingham and Shenandoah counties, and finally unite on the southern border of Frederick; the main or south-eastern branch having flown at their point of union, by comparative courses, to the N.E. 85 miles. Gradually inclining upon the base of Blue Ridge, the Shenandoah below the union of its two constituents continues north-eastwardly 35 miles to its junction with the Potomac, at Harper's Ferry, after an entire comparative course of 120 miles.

The entire upper valley of Potomac stretches along the Blue Ridge, from south-west to north-east, 160 miles from the sources of the Shenandoah to those of Conecocheague. It is 75 miles where broadest, between the Alleghany at the source of Potomac to the Blue Ridge, opposite the sources of Hedgman river; but the mean width is only about 50 miles; area 8000 square miles.

By reference to the tables of relative height, it will be seen, that the low water level in the river, at its passage through Blue Ridge, is 288 feet above the level of tide water in Potomac. The lowest elevation that can be given to any part of the arable soil of Upper Potomac valley, is at least 350 feet, or a full equivalent to a degree of latitude, as regards mean temperature. Under the head of the Appalachian chains, the rapid rise of their respective vallies were shown, and we may, to save reference, observe here, that the valley of the South Branch, and which is continued northwardly across the valley of Juniata, and southwardly in the higher valley of James river, has its lowest point of depression between Susquehannah and New river at Cumberland, where the common water level is 578 feet above the Chesapeake tides. We may therefore safely assume 600 feet as the lowest arable surface of the South Branch of Potomac. Where the Ohio and Chesapeake canal is to pass the Alleghany mountain, between the sources of Little Will creek and Casselman river, or the extreme eastern branch of Youghiogany river, the summit level is 1903 feet by actual admeasurement. The extreme highest peaks or ridges of Alleghany exceed 2800 feet; and we are safe in stating a difference of 1200 feet between arable land of the lowest part of the Upper Potomac valley, and the most elevated farms along the higher mountain vallies; and as many of these farms are actually on mountain table lands, the rapid change of temperature experienced in a few miles is fully accounted for from relative height.

Passing the Blue Ridge the Potomac flows 15 miles S.E. by E. to the influx of Monocacy, and passage of the main stream through the South East Mountain. At this latter pass the water level is still 224 feet above tide water; and similar to its inflections below Cumberland, and below its passage through the Kittatinny, the Potomac bends 5 or 6 miles to the south-westward, after passing South East Mountain, and thence very gradually curves to a course of S.E. which it maintains 30 miles to its final descent over the outer primitive ledge, into tide water at Georgetown. Below the head of tide water in Potomac, occurs one of those river resemblances which demonstrate the extent of mountain influence. Like the Delaware below Trenton, and the Upper Chesapeake below the influx of Susquehannah, the Potomac, after meeting the tide, first inflects along the base of the primitive ledge, by a course south of west upwards of 20 miles, and thence, by a very extensive curve, regains a south-eastern direction. It is in the above noted great curve that the Potomac so nearly approaches to the Rappahannoc, as we have shown under the head of the latter river.

From its leaving Blue Ridge to where it finally quits the primitive ledge, between Charles county in Maryland, and Stafford in Virginia, the Potomac receives from the left Cotoctin, Monocacy, Seneca, Rock, East Branch, Piscataway, and Mattawoman; and from the right, Goose creek and Occoquan, with many of lesser note from each shore.

The Monocacy valley is a part of that between Blue Ridge and South East Mountain, the main or middle stream flowing, a little south of west, along the mountain valley, having interlocking sources with those of Conewago and Codorus branches of Susquehannah, comprising the far greater part of Frederick county, in Maryland, and the southern part of Adams, in Pennsylvania; length 50 miles, mean breadth 20, and area 1000 square miles.

Below the influx of Monocacy, no stream above the size of a large creek enters Potomac from Maryland. Rock creek, entering between Washington and Georgetown, and the North East Branch, both rise near Mechanicsville, in Montgomery county, and within twenty miles from the city. The latter opens to the width of a river, and forms the harbour at the United States navy yard, and gains importance from this circumstance; but its extreme head is not quite as far remote from their common recipient as is that of Rock creek. Indeed, from the source of the Patuxent, in South East Mountain, to its outlet into Chesapeake, the distance between its channel and that of Potomac in few places amounts to twenty miles, and does not average fifteen. On the opposite side to the vallies of Moncacy, Rock creek, and North East Branch, there is a small section of Virginia drained into Potomac. This section, embracing the northern part of Fauquier, and all Loudon, Fairfax, and King William counties, is watered by Goose creek, Occoquan, and some smaller streams. But, as noticed under the head of Rappahannoc, the valley of Potomac becomes restricted to a narrow slip below tide water in the former. The whole of that part of the basin of Potomac below the Blue Ridge, from the source of Monocacy to Smith's Point, on the right side of the mouth of Potomac river, is in length 165 miles; the mean breadth 30; and area 4950 square miles.

Combining the two sections above and below the Blue Ridge, the whole basin of Potomac extends over an area of 12,950, say 13,000 square miles. Extending in Lat. from 37° 50′ to 40° North, and in Lon. from 0° 45′ E. to 2° 45′ W. from W.C.

From its relative position, and from the great distance inland to which its channel admits ships of the heaviest draught, the basin of Potomac is a very interesting object in physical and political geography; and it is naturally, and by the erection of the Baltimore and Ohio Rail Road, already artificially connected with the western shore of Chesapeake Bay, between its own estuary and that of Susquehannah. In a direction very nearly from north to south, and from the southern boundary of Pennsylvania to the lower part of St Mary's county, Maryland, extends a strip of about 110 miles in length, and where broadest, in Harford and Baltimore counties, 45 miles wide. The mean width, however, about 25, area 2750 square miles. This slope is drained by Patuxent, Patapsco, and Gunpowder rivers.

The western shore of Chesapeake, broken into minor bays by the confluent rivers, is opposed by another slope still more indented. The eastern shore of Chesapeake is, in one respect, very remarkable; that circumstance is, that the confluent creeks and rivers rise almost on the margin of the Atlantic Ocean from Cape Henry to Indian river; and again, a similar remark, with some limitation, may be extended to that part lying between Chesapeake and Delaware bays, as, in the latter case, the comparatively large streams of Pocomoke, Nantikoke, Choptank, Chester, Sassafras, and Elk rivers, are opposed by a series of mere creeks, flowing across a strip of about one hundred miles in length, with a mean width of fifteen. The whole elliptic curve, from Cape Charles to the head of Elk river, following the shores of the Atlantic Ocean and Delaware Bay, in a distance of two hundred miles, does not exceed an average width of more than ten miles; area 2000 square miles.

The Chesapeake slope of the peninsula we are surveying is also very narrow, not exceeding a mean breadth of five miles for the first seventy miles from Cape Charles to the mouth of Pocomoke river, but thence rapidly widens in the basins of Pocomoke, Nantikoke, and Choptank rivers to a mean breadth of 50 miles, and length of 70 miles. Again, contracting over the basins of Chester and Elk rivers, to a point towards the source of the latter, the whole eastern slope of Chesapeake Bay presents an elongated ellipse of 200 miles from south to north, mean width 25, and area 5000 square miles; extending in Lat. from 37° 7′ to 40° N., and in Lon. from 0° 40′ to 1° 40′ E. from W.C. The entire peninsula, by careful measurement, including the space between the head fountains of Elk river and Cape Charles, embraces a superficies within a trifling fraction of 7000 square miles; extreme breadth 65, but mean breadth 30, very nearly. From these elements, five-sevenths of the peninsula is drained into the Chesapeake Bay.

For specific description of the residue of the Chesapeake basin, see article Susquehannah. The relative extent and elevations of the sections are shown by the subjoined tables.

TABLE VII.

Table of the Sub-basins and Aggregate Extent of Chesapeake Basin.

Basins.	Length.	Mean Breadth.	Area.	Between Latitudes N.		Between Longitudes from W. C.	
James River,	250	40	10,000	36 40	38 20	1°00′E	3°40′W.
York,	130	20	2,600	37 15	38 16	0 41 E.	1 12 W.
Rappahannoc,	140	20	2,800	37 34	38 44	0 41 E	1 25 W.
Potomac, above Blue Ridge,	160	50	8,000	37 58	40 05	0 25 W.	2 45 W.
Potomac, below Blue Ridge,	165	30	4,950	37 50	39 55	0 45 E.	1 00 W.
Patuxent, Patapsco, &c.	110	25	2,750	38 10	39 42	0 45 E	0 05 W.
Eastern Shore of Chesapeake,	200	25	5,000	37 07	40 00	0 40 E.	1 40 E.
Susquehannah,	230	125	29,250	39 33	42 53	2 16 E	1 41 W
Chesapeake Bay,	180	20	3,600	37 00	39 33	0 26 E	1 24 E.
Aggregate,	500	138	69,000	36 40	42 53	2 16 E.	3 40 W.

TABLE VIII.

Table of the Ascents and Descents from Tide Water at Weldon, on Roanoke, by Salem, and thence over the Alleghany Chain into the Channel of New River, and down that stream and the Great Kenhawa to the Ohio River at Point Pleasant.

Route.	Distances in Miles.		Ascent or Descent.	Elevation in Feet above mid-tide.	
Tide water to Salem,	224	222	rises.	1002	1002
Salem to Forks of Roanoke,	11¾	235¾	"	176	1178
Mouth of Elliott creek,	11¼	247	"	221	1399
Beginning of summit level,	12¾	259¾	"	650	2049
Over summit level,	5¾	265½	"		
From western end of summit level down Meadow creek and Little river to New river,	11¼	276¾	falls.	309	1740
Thence to mouth of Greenbriar river,	83½	360¼	"	358	1382
Bowyer's Ferry,	45¾	406	"	400	982
Foot of Great Falls of Kenhawa,	22	428	"	311	641
Mouth of Great Kenhawa at Point Pleasant,	94	522	"	108	533

TABLE IX.

*Table of the Ascents and Descents from Tide Water in James River at Richmond, along the Channel of James River to the Mouth of Catawba Creek, thence up the latter and over the intermediate Summit into the Valley of Roanoke at the Forks of the latter above Salem, and thence, as in Table VIII. to the Ohio River at the Mouth of the Great Kenhawa.**

Route.	Distances in Miles.		Ascent or Descent.	Elevation in Feet above mid-tide:	
Pattonsburg, as in Table X.		198½	rises.		806
Mouth of Catawba,	14¼	212¾	"	80	886
Forks of Roanoke,	51	263¾	"	292	1178
Summit level, as in Table VIII.	24	287¾	"	871	2049
Thence, as in Table VIII. to the mouth of Greenbriar,	94¾	382½	falls.	667	1382
Thence to the mouth of Great Kenhawa, as in Nos. VIII. and X.,	161½	544¼	"	849	533

TABLE X.

Ascents and Descents from Head of Tide Water in James River at Richmond, along the Channel of James, Green Briar and Kenhawa Rivers to the Ohio River at the Mouth of Great Kenhawa; and crossing the Appalachian System by way of Covington and Green Briar river.†

Route.	Distances in Miles.		Ascent or Descent in Feet.	Elevation in Feet above mid-tide.	
From tide water to Maiden's Adventure,		29	rises.	140.5	140.5
Columbia,	30	59	"	39.28	179.78
Big Bremo,	11	70	"	29.22	209.
Hardware river,	3½	73½	"	33.27	242.27
Scottsville,	8	81½	"	15.11	257.38
Warminster,	19	100½	"	58.37	315.75
Lynchburg,	50	150½	"	185.88	501.63
Blue Ridge,	20	170½	"	103.47	605.1
Through do.	6½	177	"	94.75	699.85
Pattonsburg,	21½	198½	"	106.23	806.08
Covington,	58½	257	"	416.	1222.08
Mouth of Fork Run	16½	273½	"	432.	1654.08
Beginning of summit level,	2½	276	"	264.	1918.08
Along summit level,	4½	280½	"		
From western end of summit level down Howard creek to Greenbriar river,	8	288½	falls.	249.	1669.08
Down Greenbriar to its entrance into New river,	49	337½	"	287.	1382.08
Bowyer's Ferry,	45½	383	"	400.	982.
Foot of Falls in Great Kenhawa,	22	405	"	341.	641.
Mouth of Great Kenhawa,	94	499	"	108.	533.

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* Table IX. has a common route with No. VIII. below the mouth of Greenbriar river, and with No. X. from tide water to the mouth of Catawba creek.

† The traverse of Table X. intersects those of VIII. and IX. at the mouth of Greenbriar.

The three Tables VIII., IX. and X., as far as the elements on which they are founded are correct, must be of great service in showing the intermediate elevations, between tide water in the Roanoke and James river, and also of the connecting ground between those rivers in the higher part of their respective vallies above Blue Ridge. It ought, however, to be carefully observed, that in all tables of elevations taken from measurements along the streams having canal operations in view, that the height at any given place must be below the arable surface; therefore, as applied to an estimation of aerial temperature, without allowance for greater height, the results would in every instance yield a too high temperature. The summit levels are also much below the mean height of the mountain chains, but they give, where the surveys have been carefully made, the lowest gaps or passes of the chains in the vicinity of the line of survey.

TABLE XI.

Table of the Ascents and Descents along the Channel of Potomac, from Tide Water at Georgetown to Cumberland, and thence, following the contemplated route of the Chesapeake and Ohio Canal, over the Appalachian System by the Channels of Youghiogany and Monongahela to the Ohio at Pittsburgh.

Route.	Distances in Miles.		Ascent or Descent.	Elevation in Feet above mid-tide.	
Mouth of Monocacy,		44	rises.		224
Harper's Ferry, at passage of Potomac thro' the Blue Ridge, and influx of Shenandoah,	24	68	"	62	286
Williamsport,	28	96	"	69	355
Hancockstown,	31	127	"	52	407
Old Town,	42	169	"	82	489
CUMBERLAND,	17	186	"	84	573
Mouth of Little Wills creek,	13¾	199¾	"	309	882
Eastern end of summit level,	15¼	215	"	1016	1898
Western end of summit level,	5¾	268¾	"		
Mouth of Middle Fork creek,	16	284¾	falls.	216	1682
Mouth of Casselman river,	20	304¾	"	420	1262
Comnellsville,	27½	332¼	"	432	830
Mouth of Youghiogany,	43¾	376	"	152	678
PITTSBURGH,	14	390	"	35	643

The Pennsylvania Canal, or, more correctly, the net-work of canals constructed and constructing in Pennsylvania, and which connect the basin of Delaware with the valley of Ohio, by traversing the basin of Susquehannah, have conferred intense interest on the relative heights. In order, however, to preserve as much clearness as practicable, we now proceed to a review of the Delaware, Hudson, Canadian, and Ohio natural sections, before inserting the tables of elevation, which exist on the canal routes uniting Pennsylvania, New Jersey, New York, and Ohio. The canal routes themselves, also, can be much more conspicuously delineated when brought under one field of view.

Delaware basin, from physical position, and from the immense advance of human power on its surface, is a region of great importance in the geography and statistics of the United States. Taken in its fullest extent, Delaware basin has that of Susquehannah to the west and north-west; that of Hudson north and north-east; the eastern slope of New Jersey to the south-east, and opens, by a wide bay, to the Atlantic Ocean on the south. Its greatest length is very nearly, from north to south, 250 miles; and also deviating but slightly from the meridian, 2° East from W.C. In Lat. it extends from Cape Henlopen, 38° 43′ North, to the sources of the Coquago branch, 42° 30′ North, and in Lon. from 0° 42′ East to 2° 35′ East. The greatest breadth is about ninety miles from the sources of Tulpehocken to those of Assanpink; but the mean width is fully estimated at 45 miles; area 11,250 square miles.

Without taking the extreme elevations of the Catsbergs, from which issues the Popachton branch of Delaware, we may, however, safely estimate the extremes of arable height on the Delaware basin at 1800 feet, or an equivalent to three degrees of latitude, and consequently, as the actual extremes of latitude is 3¾°, the extremes of temperature is 6¾°.

Delaware Proper is formed by two main confluents, Coquago and Popachton, both rising in the Catsbergs. The Coquago, or most remote, has interlocking sources with those of Susquehannah and Schoharie, and flowing south-west 55 miles, until within 8 miles from the channel of Susquehannah, where the two streams, approaching thus near, retreat from each other in opposite directions. The Delaware, rapidly inflecting to south-east, receives in that direction, at 12 miles, the Popachton, and preserving the latter course 50 miles, by comparative distances, but very winding channel, to the extreme northern angle of New Jersey and influx of Nevesink river.

The Popachton issues from the Catsbergs, and probably contains the highest fountains of the Delaware, flows south-west, very nearly, an equal distance with the Coquago, above the great bend of the latter; the two streams preserving a relative distance of from 8 to 10 miles asunder.

At the influx of Nevesink, the Delaware reaches, and is turned to south-west by the Kittatinny chain, down which it flows 35 miles, to the influx of Broadhead creek, and the passage of the stream through the Kittatinny chain at the pass called the Delaware Water Gap. Here this now large navigable stream assumes a course a little west of south obliquely over the Kittatinny valley, 20 miles, to the influx of the Lehigh, at the foot of the Blue Ridge.

The beautiful mountain stream, the Lehigh, is the lowest and largest of three considerable confluents of the Delaware, which drain that part of the basin of the latter above Blue Ridge, and westward of the main stream.

Lackawaxen, become important from its mines of anthracite coal, and canals already constructed along its valley, draws its sources from the same mountain chain from which rises the Lackawannoc branch of Susquehannah, and, flowing south-eastward about 30 miles comparative distance, falls into the Delaware between Wayne and Pike counties. It is a very large stream when the volume is compared with the brevity in length.

Broadhead creek is a much less important stream than the Lackawaxen, and flowing from the lower part of Pike and higher part of Northampton, enters Delaware river in the latter county, and immediately above the Water Gap.

The Lehigh heads with both the preceding streams, and with some of the south-eastern creeks of Lackawannoc. Its extreme western source is about five miles eastward from the channel of the Susquehannah at Wilkesbarre. The numerous confluent creeks rising on a table land of at least 1400 feet mean height, flow generally to the south-westward 20 miles; unite between Northampton and Luzerne counties, inflect to a course of a little east of south 25 miles, to the north-western foot of Blue Ridge.

In the latter course, the channel of the Lehigh is tortuous, and falling upwards of 800 feet, or, if we allow 40 miles to the actual channel, 20 feet per mile. The stream is a series of small cataracts, but, what is truly remarkable, with no actual fall, in the true meaning of the latter term.

Passing the Blue Ridge, the Lehigh inflects to S.S.E. 18 miles, by comparative distance, to the influx of Little Lehigh and north-western foot of Blue Ridge, at Allentown. Turned to north-eastward by the Blue Ridge, the Lehigh flows down that chain 12 miles, to its union with the Delaware, at Easton. The arable soil, or the point on which the lower part of Easton stands, is about 200 feet above tide water, and the higher sources of Lehigh being at the least 1500 feet, gives a difference of arable height, to the extremes of its valley, of 1300 feet. In direct distance, it is only about 45 miles from the higher spring to the outlet of this mountain river. The prodigious masses of mineral coal found in the mountains of the Lehigh have enabled human genius and labour to render its precipitous current commercially available.

Traversing the Blue Ridge, and continuing to the southward 10 miles, having passed in the latter distance the South East Mountain, the Delaware turns to the south-eastward 35 miles, to its fall over the primitive ledge, and meeting the tides at Trenton. Similar to the head of Chesapeake Bay, or in fact the Susquehannah, as also the Potomac below Georgetown, James river below Richmond, and the Roanoke below Weldon, the Delaware bends along the shelf of the primitive ledge on its mingling with the tides. This phenomenon is, however, most conspicuous, and preserved to a greater distance in the Delaware than in either of the other rivers in which we have shown its existence.

Having become a tide water channel, the Delaware curves below Trenton gradually to the south-westward, and maintaining that course, by comparative distances, 60 miles, receives the Schuylkill from the north-west, at very nearly mid-distance.

Schuylkill river is the largest confluent of the Delaware, interlocking sources with those of the Lehigh, and also with those of the numerous confluents of the Susquehannah, from the Nescopec to the Conestoga inclusive; drawing its higher and principal sources from the rugged mountain valley above Kittatinny: it is, indeed, the same valley, or series of vallies, which gives source to the Lehigh. The upper Schuylkill drains a region of from 400 to 1200 feet, exclusive of the mountain ridges. Falling from this elevated tract, the higher branches unite above, and traverse the Kittatinny chain by the Schuylkill Water Gap, after a general course of 20 miles. After its passage through the Kittatinny, the stream assumes a course a little east of south, 18 miles, to the influx of Tulpehocken from the westward, and, traversing Blue Ridge at Reading, turns to the south-eastward, and flowing in that direction 45 miles, by comparative courses, to its passage over the primitive ledge, in the vicinity of Philadelphia; where, turning to the southward five miles, joins the Delaware, after an entire comparative course of ninety miles. The valley of Schuylkill lying between, and in a remarkable manner parallel to the contiguous parts of the basins of Susquehannah and Delaware, is a parallelogram of 80 by 22; area 1760 square miles.

From the head of tide water, the channel of the Delaware gradually widens, and assumes the features of a bay: at Philadelphia, it is about a mile wide, and continues from one to two miles in breadth until passing the great bend, near where it is now connected with the Chesapeake Bay by Chesapeake and Delaware canal; but here turning to south-east and rapidly widening into what is more particularly called Delaware Bay, a sheet of water 60 miles in length, and from two or three, to twenty miles in width. This expansive opening to the Delaware basin is terminated on the north-east by Cape May, and south-west by Cape Henlopen.

The numerous shoals and channels render the navigation of Delaware Bay intricate, but it admits the entrance of the largest vessels of war as high as Reedy Island, and merchant ships of large draught to Philadelphia: sloops and steam boats ascend to the lower falls at Trenton. The artificial navigation of the basin will be noticed in the sequel.

The Delaware channel is, with the exception of the higher Coquago, a political boundary. From where it reaches North Lat. 42°, above the mouth of Popachton, to the Kittatinny chain, it separates New York from Pennsylvania; from thence to 12 miles below the influx of Schuylkill, it forms the boundary between New Jersey and Pennsylvania; and finally, Delaware Bay has New Jersey to the north-east, and the state of Delaware south-west.

The head of tide water in Delaware and Raritan rivers are only 26 miles asunder, though the distance between their respective openings to the ocean is 120 miles. The intermediate space forming the south-eastern part of New Jersey, and, if the entire basin of Raritan is included, embracing more than two-thirds of that state, is a slope of 140 miles from south to north, mean width about 25, and area 3500 square miles.

Of this slope, from Cape May to Sandy Hook, the Atlantic shore, with a slight elliptic curve outwards, preserves a similar character with the coast of Maryland, Virginia, and the Carolinas. Long, narrow sand islands stretching in a chain outside of shallow and narrow sounds. The inlets, numerous between the outlets of the Delaware and Hudson, are, however, shallow, admitting only a coasting navigation. The tides, sweeping round this almost insulated tract, penetrate the smaller rivers only 15 or 20 miles. The remark may be repeated, that the peninsulas between Chesapeake Bay and Delaware Bay, and that again between Delaware Bay and river, the Atlantic Ocean and Hudson Bay, differ from Long Island only in the circumstance of the latter being separated from the continent by a sound. Suppose the others cut off in a similar manner, and the resemblance will be obvious to the most casual observer.

The very remarkable basin of the Hudson follows that of Delaware and the Atlantic slope of New Jersey. Forming the great link between the Atlantic Ocean and the vast basin of Canada, the Hudson basin has that of Delaware south-west; the extreme north-eastern part of that of Susquehannah on the west; that of St. Lawrence north-west, north, and north-east; the basin of Connecticut east; that of the Housatonick south-east; and the Atlantic Ocean south. In Lat. it extends from the southern end of Staten Island, 40° 30′, to the extreme fountains of the main Hudson, 44° 8′ North. These two extremes, lying very nearly in Lon. 3° East from W.C., stretch also along the greatest length of the basin, or to an unimportant fraction of 250 miles; mean width 55, and area 13,750 square miles.

The physical features of this basin are in a very striking manner curious. Like that of the Delaware, the Hudson Basin extends very nearly from south to north; but the Delaware basin rises from the primitive ledge by gradual acclivity, whilst the tide valley of the Hudson is protruded inland over the primitive to the margin of the central secondary. Some of the peculiar features of the Hudson basin were noticed under the general view of the Appalachian system, and by reference to what was observed under that head, it will be seen that the deep tide vale or narrow bay of the Hudson is a part, about one half of an immense chasm in the continent of North America, extending from the Atlantic Ocean, in a direction a little east of north to the St. Lawrence. Along this chasm the tide is borne inland 160 miles to near the junction of the two main branches of the Hudson. Beyond the head of the tide, the valley or channel of Hudson Proper, rises gently for another stretch of 40 miles. Thence rises a neck of land, 18 miles wide, which intervenes between the basin of Hudson and Lake Champlain, but even here the summit level does not rise to 141 feet above the tides in Hudson river.

From these observations it must be seen that the basin of the Hudson is composed of two inclined plains. These opposing plains are of very unequal extent. The western and most extensive stretches the entire length of the basin, and advancing from south to north, is drained by the Passaick, Wallkill, Esopus, Catskill, Norman's Kill, Mohawk river, Sacondago river, and Hudson Proper. Of these, the Passaick, Wallkill, Esopus and Mohawk have gained political and moral consequence from having been made respectively subservient to canal construction.

Between the sources of Esopus creek and those of the Schoharie, or southern branch of the Mohawk, rises that remarkable mountain nucleus, particularly called the Catskill Mountains. This group, though of a less extent, is specifically similar to the valley of Mexico, and the European valley of Bohemia. Some of the peaks rise to near 4000 feet, and the main mass rises between 10 and 25 miles from the tides of the Hudson, 40 miles below their head.

From this comparatively very elevated tract the Schoharie is poured northwardly into the deep vale of the Mohawk. The latter, by its channel extending from the main stream near the head of tidewater, in a direction a little north of west, carries a chasm in the continent, rising in no place to 426 feet above mid-tide level in the Hudson. The Mohawk has interlocking sources with the Susquehannah Proper, Unadilla and Chenango, with the confluents of Oneida Lake, and those of Black river. The upper branches of the Mohawk flow towards each other and unite on a table land, where, whilst in a state of nature, the water in times of flood separated; part flowing to the westward into Oneida, and thence by the Oswego, or Onondago river, into Lake Ontario; whilst the other part flowed down the Mohawk into the Hudson.

This table land between the Mohawk and Oneida Lake, is the lowest depression in the Appalachian system, and at right angles to its chains, from the south-western termination of the system to the Saint Lawrence, near the confluence of that great stream and the Ottawas, and has been, to the honor and incalculable advantage of New York, made the route of part of a canal uniting the Hudson tides to the water of Lake Erie. To this, the still deeper depression of the Hudson and Lake Champlain route is no exception, as the latter extends evidently along, and not at right angles to the mountain vallies.

The Hudson in full contrast with the Mohawk issues by numerous sources from the Sacondago chain, and from a rather elevated table land, cold, sterile and forbidding. The region from which flows the Sacondago and Hudson Proper, the sources of Oswegatche, Grass, Racket and St. Regis, into St. Lawrence, and the Sable and Sarenac rivers into Lake Champlain, is perhaps the least inviting tract in the United States. It abounds in mountain ridges, lakes and marshes, giving source to streams which find their respective recipients on borders of an entirely different character. This moist, cold, and repulsive region has remained in great part desolate and unsettled, whilst improvement has rapidly advanced around its outer circumference, or along the outlet of its rivers.

The entire western slope of the Hudson basin so diversified in feature, latitude and elevation, stretches 250 miles from south to north. Where widest along the valley of the Mohawk, it is 90 miles in breadth, but narrowing to the northward, and still more to the southward of the Mohawk valley, and the area being 9500 square miles, the mean breadth is 38 miles.

The eastern slope of the Hudson basin extends 170 miles from Haerlem river or strait, to the sources of Batten Kill, with a mean width of 25 miles; area 4250 square miles. Between Haerlem river and the Blue Ridge, or, as there called, the Fishkill Mountains, Croton river and some smaller creeks, drain the eastern slope of the Hudson. Above the mountain pass of the Highlands, this slope is limited to the eastward by the Blue Ridge, and is drained by Fishkill, Wappinger, Ancram and Kinderhook creeks; and thus far the Hudson basin is opposite to that of Housatonick: but northwards of the sources of the latter river, those of Hoosack and Batten Kill originate in the continuation of the South East Mountain, there called Hoosack Mountain; the same chain known still farther northwards as Green Mountains.

To an eye sufficiently elevated the whole Hudson basin would present a most interesting appearance. The main channel, in particular below the tides, generally a deep chasm lined with immense walls of rock. So deep indeed is this long narrow bay as to be very seldom visible from the roads along either shore. This chasm is not as on the St. Lawrence the lowest depression of a gradual declivity from the outer exterior border of the basin, but an abrupt fissure in the rocky base of the whole physical section. The rivers and creeks flow moderately until near their recipient, and are then precipitated with great rapidity, yielding two long series of water falls, and affording, perhaps, the most extended water power in the United States.

Into this profound chasm, ships of nearly the heaviest burthen can be navigated above the Highlands, and sloops to Troy, within 2 miles off the confluence of the Hudson and Mohawk, and from its surface so little can be seen of the enchanting prospects which abound over the basin on both sides, that the voyager feels, for hours, as if immured between craggy and precipitous walls of rock. At intervals, however, glimpses of the distant mountain, the cultivated fields, the neat and flourishing towns, the dashing water fall, and the elegant villas crowning the steeps; all give intimation of the rich and varied regions beyond the limits of vision from the river surface. But to resume our general survey.

Under the head of Appalachian system, it was shown that the physical sections on each side of the Hudson were united by the mountain chains, though a tide channel did in one place pass over a gap in the system. On some other points of view, that region of North America, bounded on the south-west by the Hudson, Lake Champlain and Richelieu river; on the north-west by Saint Lawrence river; north-east by the Gulf of St. Lawrence, and east, south-east and south, by the Atlantic Ocean, has so many peculiar features as to constitute a very distinct physical section. This section approaches a parallelogram of 500 miles from south-west to north-east, and with a mean width of 200 miles; area 100,000 square miles. Politically it contains of the United States, the eastern slope of New York, with all Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire and Main; and of the British North American possessions, the south-eastern slope of Lower Canada, and all New Brunswick, and Nova Scotia. Exclusive of the peninsula of Nova Scotia, which is very nearly insulated, the main body of the natural section under review is divided by its rivers into two very unequal slopes or inclined plains. That which rapidly falls towards the Saint Lawrence, is a strip of 560 miles in length; the utmost breadth along the valley of Saint Francis river, about 100, but where narrowest, between the extreme northern sources of St. John's river and the channel of St. Lawrence opposite the mouth of Saguenay river, not quite 10 miles, and perhaps overrated at a mean width of 50, and area 28,000 square miles. The largest and longest river of this confined slope is the St. Francis, heading with the Connecticut, and having a valley of about 110 miles in length.

The opposing slope, with a declination very nearly southward, gives source and course to the great streams of Connecticut, Kennebec, Penobscot and St. John's, which have their remote sources in the dividing ridge between the Atlantic and St. Lawrence waters, and also to several of lesser length of course and magnitude of volume, that rise and flow in the intervals which separate the basins of the former and more considerable rivers.

The character of coast, prevalent from the outlets of the basins of Santee and Pedee to the mouth of the Hudson, is perpetuated along the north-eastern shore to Cape Cod inclusive; if we regard, as on every physical principle we ought, Long Island as the real Atlantic shore. Passing Cape Cod and entering the deep gulf between the south-eastern shores of Massachusetts and the south-western of Nova Scotia, a new order of coast commences. The ocean border, hitherto a sandy flat, or where rocky or more elevated, the elevations moderate, now becomes bold and prominent. The points and intervening bays numerous, and harbours deep and safe.

One of the most remarkable, and, whether regarded as a natural phenomenon or as influential on the operations of man, the most important, may be appropriately noticed in this place. The Atlantic tides from the Bahama channel, along the coast, increases in height, advancing north-eastward. The increase, it is probable, if not disturbed by the irregular protrusions of the land, would follow a nearly regular law of progression, and this is with some allowance the case between very prominent points. From the Bahama channel to Cape Hatteras, the increased height follows a scale but little influenced by the moderate intervening projections; but passing Hatteras the increase is at once very rapidly augmented. The tides, however, again resume and follow a regular ratio of increased height, with slight deviations to Cape Cod.

From the Florida point, where mean tide does not exceed, if it amounts to two feet, to Buzzard Bay, on the south side of Cape Cod, the increased height has reached an extreme of 9 feet. Viewing the Gulf between Cape Cod and Nova Scotia, with its retiring bays and salient points, and without any knowledge of facts or their causes, we would be unprepared to expect the tides to be doubled in elevation, on passing the narrow neck between Buzzard and Cape Cod bays, yet such is the fact. The gulf, which to avoid circumlocution we may call the Gulf of Maine, extends from Boston harbour to the coast of Nova Scotia, 250 miles, and if extended to the head of the bay of Fundy, upwards of 400 miles; its depth inland about 140 miles.

Into this wide mouthed gulf the waves of the Atlantic Ocean pour with inconceivable elevation and force, and retreat again with corresponding violence. Rapidly as the mean height of the tides south-west from Cape Cod augment, advancing from south-west to north-east, their increase is still more rapid from the bottom of Cape Cod bay, to that of Fundy. The actual mean and extreme tides of Fundy have been, no doubt, exaggerated greatly, when their lowest term is given at from 30 to 40, and extreme from 50 to 60 feet; but retrenching one half, would leave this tide volume far the most elevated on earth.

What are the causes of the increase of the Atlantic tides along the coast of the United States and New Brunswick, and their great excess at the north-eastern extreme?

These questions remain *desiderata*, and without pretending to determine such a problem, it may be suggested, that the Gulf Stream is the immediate cause. This oceanic current at its outlet from the Gulf of Mexico, between Florida and Cuba, is met, increased and turned along the Florida shores, by another current between Cuba and the Bahama islands. Confined to a width of from 40 to 60 miles, until clearing the whole Bahama chain, the Gulf Stream is rapid, and for the next 500 miles of its course, across the elliptic gulf in front of Florida, Georgia and the two Carolinas, though the stream widens and of course weakens, it still retains sufficient force to lessen the height and deflect the course of the tide.

Between Cape Hatteras and Cape Cod sweeps inward another elliptic gulf, of not much less length of chord than that between the Bahamas and Hatteras; along the second, or as we may call it, the middle Atlantic Gulf of the United States, the great ocean river flows with an expanded breadth and diminished elevation, and here the land swell is found to have increased in direct ratio with the diminution of the Gulf Stream.

Into the third, or Gulf of Maine, at the distance of 1000 miles from the northern outlet of the Bahama channel, the accumulated tides are left to fall with their whole weight, as opposite to its front of 250 miles, the force of the Gulf Stream has become almost negative.

Whilst, whether the preceding is in whole or in part a solution of the phenomena of the Atlantic tides along the coast of the United States, New Brunswick and Nova Scotia, remains for future investigation, we may notice a very remarkable and salutary effect of the increased height and, of course, violent ebb and flow of the tides on the coast of the Gulf of Maine. From the lower harbours of Chesapeake Bay, inclusive to the south-west, the navigation of the United States is not materially interrupted by ice, but from the Delaware inclusive to the north-eastward, the harbours and rivers are liable to be closed or greatly obstructed by winter frosts. Were it not prevented by the peculiar phenomena of the tides, the interruption from ice would augment with the latitude; but the very violent currents produced twice in every astronomical day, by the tides along the shores and in the tide part of the river channels and bays, prevent the formation of solid or compact fields of ice. This is evidently the cause why, that in severe winters, the harbours of Massachusetts, New Hampshire, Maine, and New Brunswick are more available for navigable purposes than are those of Delaware, Pennsylvania, New Jersey, New York, Connecticut, and Rhode Island, or those even of Massachusetts to the south of Cape Cod. With these remarks we return to our general survey.

Both in our review of the mountains, and of the Hudson basin, we have shown that the latter was separated from the physical section last noticed, by the continuation of the Blue Ridge and South East Mountain. If we extend our view beyond the estuary of the Hudson, the first remarkable object which meets our eye is Long Island. That the Chesapeake and Delaware peninsula, the Delaware and Hudson peninsula, the Massachusetts peninsula, and Nova Scotia are all specifically similar to Long Island, has already been remarked. Though on a much more contracted scale, similar resemblances exist in Staten Island and Manhattan island, the latter rendered of so much importance from having on its surface the city of New York.

Long Island lies between N. Lat. 40° 34′ and 41° 10′, and Lon. 2° 58′ and 5° 08′ E. from W.C. The mean range is N. $69\frac{3}{4}$° E.; utmost length from the Narrows to Montauk Point, within a trifle of 120 statute miles. The utmost width nearly along the line between Queens and Suffolk counties, 20 miles; the mean width about 8, area 160 square miles.

The deep sound which separates Long Island from the continent, bears a strong resemblance in extent and form to the island, and both are followed by a bold and rather abrupt coast, the outer abutment of a slope, down which flow Housatonic, Connecticut, Thames, and the smaller rivers entering Narraganset and Buzzard Bays.

Housatonick comes first in order, advancing eastward from the Hudson. The mountain chains now stretching from south to north, discharge the rivers southwardly along their intervening vallies. The Housatonick, interlocking sources with those of the Hoosack, on the table land of Berkshire, at an elevation of from 900 to 1200 feet, and between the South East Mountain and Blue Ridge. From this elevated source the Housatonick flows, by comparative courses, 65 miles, in a direction a little west of south, and in a striking manner parallel to the Hudson and Connecticut rivers; thence piercing the South East Mountain, the Housatonick bends to a course south south-east 40 miles, to its efflux into Long Island Sound, after an entire comparative course of 105 miles.

Wallingford basin, from the brevity of its confluents, would not deserve specific notice in a general view, were it not rendered important from the fine city of New Haven, and from a proposed communication by canal between its principal tributary, the Quinipiack, and Farmington river and canal. The Wallingford basin, only 30 miles in length, intervenes between that of Housatonick and Connecticut. Confined, however, as it is, the basin of Wallingford, at the distance of ten miles, is separated from that of Housatonick by a chain of mountains, and again it is detached from that of Connecticut by another chain still more elevated and distinct; both chains exemplifying a remark formerly made in this article, that the Appalachian chains, eastward of the Hudson, extended nearly at right angles to the Atlantic coast.

Taken together, the two basins of Housatonick and Wallingford may be truly considered a mountain region, extending in Lat. from 41° 08′ to 42° 34′ N., and in relative elevation differing 1200 feet. Such, indeed, is the abrupt rise of the plain from the Sound, that the tides rise but a few miles in either basin.

Both the preceding and the Hudson and Champlain basins are followed by the long and interesting basin of Connecticut. As laid down on Tanner's United States, the Connecticut has its highest source at N. Lat. 45° 15′, and enters the Sound at N. Lat. 41° 16′; of course flowing over within an insignificant fraction of four degrees of latitude. The basin lies between 4° and 5° 45′ E. from W.C.

So little does this stream incline westward of south, that in its entire length, or rather direct line from source to mouth, of, by actual calculation, 277 statute miles, the course is S. 12° 18′ W; nor does the stream in any part of its course depart 40 miles from a line drawn direct from source to outlet. The comparative length of the channel, determined by steps of 50 miles, is almost exactly 300 miles. The length of the basin is 290 miles; and in one part from the sources of Chickapee river to those of Westfield river, it is 60 miles wide, but narrowing gradually towards both extremes, the mean breadth is perhaps not far from correctly estimated at 40 miles; area, from the preceding elements, 11,600 square miles.

This beautiful stream has interlocking sources with those of St. Francis and Androscoggin or western branch of Kennebec river. From this elevated source the main stream flows by comparative courses, 70 miles to the influx of the Passampsic at Barnet Falls. The real elevation has never been well determined of the region from which are derived the sources of Connecticut, St. Francis and Androscoggin, but the height of the former at Barnet Falls has been found by actual measurement 420 feet above tide water at Hartford. At pages 13 and 14 of Armroyd's Internal Navigation, the following elements are inserted. In a direct distance above Barnet or M'Indoe Falls, the rise is 386 feet; thence in a distance of about 50 miles, following the channel from Dalton to Stewardstown, the rise is 222 feet, and from thence to Connecticut lake, above 30 miles along the channel, 562 feet. The entire fall from Connecticut lake to Barnet 1170, which, added to 420 below Barnet, gives an entire fall of 1590 feet from the level of Connecticut lake to tide water. The lake is not, however, the utmost extreme or elevation of the basin, which, it is probable, reaches, if it does not exceed, 2000 feet. The difference or level is fully equivalent to four degrees of latitude, giving to this basin as respects aerial temperature the extremes of eight degrees of latitude, or considerably more than exists in any other river basin of the Atlantic slope of the United States.

As far as the defective delineation of the mountain chains on our maps will enable us to trace the connexion, it appears that the chain which leaves the Sound between the basins of Connecticut and Thames is continued northwardly, separating in its advance beyond the Thames, the basin of Merrimac from that of Connecticut, but traversed by the latter stream between the falls at the mouth of Passumpsic and Lancaster, and thence more northwardly, separating the vallies of upper Connecticut and Passumpsic. The preceding conjecture is strongly supported by the relative elevations of the latter stream and the surface of Lake Memphramagog, with their intervening summit level.

Passumpsic river rises on a table land interlocking sources with those of Willoughby river and lake, one of the higher confluents of Lake Memphramagog, and flows thence southwardly 25 miles, to its junction with the main Connecticut. The summit level between Willoughby Lake and the source of Passumpsic is, according to Armroyd, 523 feet above Lake Memphramagog, and 755 feet above the water at the confluence of Passumpsic and Connecticut. If these elements are correct, the summit height which separates the valley of the Passumpsic from that of St. Francis, is 415 feet below Connecticut lake, and from all analogy double that descent below the extreme fountains of Connecticut river. They also expose another interesting feature in the surface of this region; that is, that Lake Memphramagog is 938 feet below Connecticut Lake.

From the preceding data, it appears that Connecticut river rises on a comparatively very elevated table land, and, passing a chain of mountains, falls upwards of 1200 feet in 60 direct miles, or upwards of 20 feet per mile, and that more than 200 miles above the head of its tides, the stream has made more than two-thirds of its entire descent. We have been more particular in our attempts to determine the real elevation of the region giving source to Connecticut, as the same elements decide the height, from which flow the St. Francis and Chaudiere into St. Lawrence, as also that giving source to the western confluents of the Androscoggin and Kennebec rivers, and more north-eastwardly to the higher sources of St. Johns river.

This tract is, in fact, independent of mountain ridges or chains, a real table land rising to from 1800 to perhaps 2200 feet above the tide level in the Atlantic Ocean. That part from which issue the extreme fountains of Connecticut lies very nearly at equal distance, one hundred and ten miles, from the head of the tides in the Kennebec, and that in St. Lawrence at the town of Three Rivers.

The great height of their fountains, compared with the brief mean length of their courses, explains the cause of the unnavigable channels of upper Connecticut, Androscoggin, Kennebec, St. Johns, Chaudiere and St. Francis.

Connecticut, however, pouring its rapid current down 1170 feet in the first 60 comparative miles of its course, has fallen at the mouth of Passumpsic, to 420 feet above tide water, 81 feet lower than James river at Lynchburg, 153 feet lower than the Potomac at Cumberland, 303 feet lower than the Susquehannah at Tioga Point, 35 feet lower than the Delaware at the mouth of Nevisink river, or where united with the Hudson and Delaware canal, and almost exactly, or at least differing only 5 feet from, the summit level of the Hudson and Erie Canal, on the Utica and Rome level.

If we compare these comparative elements with the length of their respective channels above tide water, and extend our view to the Alatamaha on one side, and to the Penobscot on the other, we shall find that, excepting the Hudson, the channel of the Connecticut, even in its natural state, is the deepest and most favourable navigable route on the Atlantic coast of the United States. It is, by the bends of the river, 220 miles from the mouth of Passumpsic to Hartford, and that distance has already been made navigable; but farther improvements are contemplated.

In proportion to its length, the basin of Connecticut is narrow, and the confluents from either side are numerous, but of no considerable length or volume. Advancing upwards along the western side, the first tributary of note is Farmington river, from Hartford county, Connecticut. Westfield river heads in the Green Mountains, opposite to the Housatonick, and falls into the Connecticut at Springfield; Deerfield river mouths below Greenfield: both the latter streams are in Massachusetts. In Vermont, the Green Mountains give source to numerous fine streams flowing south-eastwardly into Connecticut river, but none of magnitude above that of a large creek. The principal ones are West, Black, and White rivers. On the eastern side there is no stream worthy notice entering Connecticut river in the state of Connecticut. From Massachusetts enter Chickapee and Miller's rivers. From New Hampshire, also, the confluents are unimportant, if we may except the Asbuelot, entering the main stream at Hinsdale, in the south-western angle of the state; and the Amonoosuck, heading with the Merrimack and Saco, in the Green Mountains, and joining its recipient ten miles below the influx of Passumpsic.

Thames, Narragansett, and Buzzard basins follow that of Connecticut along the same slope; but, if taken together, drain only a surface of 4250 square miles, of which the Thames basin occupies 1600, Narragansett 2000, and Buzzard 650 square miles.

The tide, which penetrates the Connecticut upwards of forty miles, is arrested in the basin of the Thames, at about 16 miles from the sound. Into the Narragansett, the flood of the ocean ascends to Providence, 30 miles, and about half that distance in Buzzard Bay.

Passing Buzzard and Narragansett, we find the singular projecting curve of Cape Cod, extending 38 miles eastward into the Atlantic, and thence 32 northwards, enclosing a deep bay bearing the same name. This bay is, however, only part of one of those gulfs or lengthened bays which indent the Atlantic coast of the United States, extending about 65 miles from the narrow neck of Barnstable, and from a line drawn from the extreme northern point of Cape Cod to Cape Ann, 25 miles in depth. Following the general bearings of the coast, the curve of this sheet of water is 150 miles, and, including the extension of Cape Cod, is bordered by a slope in no part 20 miles wide, and does not exceed eight miles of average breadth. The great and abrupt increase of the tides passing from the southward into Cape Cod Bay has been noticed; yet so bold are the shores, and great the angle of acclivity of the country, that the tide in no one place penetrates ten direct miles inland. The water inside the cape is generally shallow, but that from Plymouth to Gloucester inclusive, abounds in fine harbours, of which Plymouth, Boston, and Salem may be considered the principal.

With Cape Ann the slope greatly widens, curves first westward, thence a few miles to the northward, and finally to N.N.E.; and in a distance of 50 miles the coast is broken by the outlets of Merrimack, Piscataqua, and Saco: the two former, rising in the White Mountains, interlocking sources with each other, and with those of the Amonoosuck and Androscoggin rivers, and overheading the numerous confluents of the Piscataqua.

The White Mountains of New Hampshire have attracted attention since the original settlement of the country, and the extreme height probably accurately determined at 7300 feet above the Atlantic level; but the most important part of their physical history remains obscure. Are the peaks called "White Mountains" a detached group? or are they not like the peaks of Otter and Catskill mountains, part of an extended chain? The latter has in its support the analogy of other sections of the Appalachian system, and the great elevation of the country northwardly from the main group, and which separate the sources of Connecticut from those of the Androscoggin; and again, those of Kennebec and Penobscot from those of Chaudiere.

Leaving the preceding hypothesis to future investigation, we find the sources of two rivers pouring from the southern side of the main group of White Mountains. These sources are the higher fountains of Merrimack and Saco.

The Merrimack, Saco, and Amonoosuck rivers issue from within two or three miles of each other, at North Lat. 44° 10′, and at a probable elevation of 4000 feet, on the slopes of the White Mountains.

From this elevated tract, the Merrimack flows about 20 miles to the south-west, and thence curving to a general course a little east of south, which it maintains, by comparative distances, 85 miles, to the influx of Nashua river from the south-westward. Inclining below the mouth of Nashua to the south-east and east 12 miles, the Merrimack receives the Concord river from the south, and below Chelmsford falls, and, bending to the north-eastward 25 miles, is lost in the Atlantic Ocean, at Newburyport, after an entire comparative course of between 140 and 150 miles.

The basin of Merrimack, and the quantity of water it discharges, are extensive when compared with the area. The relative position of this basin, and the course of its two southern confluents, Nashua and Concord, give it a peculiar form. Concord river rises within 12 miles from tide water, at Providence, and flowing thence northwardly, nearly in direct opposition to the course of the Merrimack, above their junction. From the latter circumstance the extreme length of the basin is 145 miles extending from south to north, not far from parallel to the opposing Atlantic coast, and almost exactly at right angles to the outlet of its own water. It was taking advantage of its singular structure, and of the elevation and course of the Concord branch, that enabled the people of Massachusetts to connect Boston harbour, by a navigable canal, with Merrimack river at Chelmsford.

Another circumstance, also, gives great interest to the Merrimack basin. With it commences, on the Atlantic coast, the lake section, of not only the United States, but of the continent of North America. It is a remark, applicable to the land protuberances of the earth, that the southern sections are devoid or deficient in lakes, whilst those mediterranean seas, on a small scale, abound in proportion to polar approach. The two vast peninsulas of Africa and South America fully sustain this contrast. Southern Europe, southern Asia, and New Holland, as far as the latter has been explored, are also striking examples. But of this geographical feature in the land area of our planet, no other section affords stronger exemplification than does North America. The lakes along the coast of Louisiana, and other places near the oceans, are mere ponds enclosed by recent alluvion, and not lakes, in the proper meaning of the term. The small lakes on the table land of Mexico, and Lake Chipala, also in Mexico, with a few very small lakes along the Chippewayan system of mountains, are the only depositions of water deserving the name of lakes, known to exist on North America below North Lat. 35°. East of the Chippewayan chains, over the whole basin of the Gulf of Mexico, drained by the Rio Grande, Colorado, Brassos, Mississippi, Mobile, and Appalachicola, and smaller rivers; and over the Atlantic slope of the United States to the basin of Merrimack, no real lakes exist of any adequate extent to merit notice. With the immense basin of St. Lawrence, and the much less, though remarkable basin of Merrimack, the change is abrupt and striking. Winnipisseogee and Squam lakes discharge their water into the left side of Merrimack, and contribute to give to the discharge of that stream a uniformity of quantity in the different seasons of the year, which is unknown in rivers of equal length, but without those natural reservoirs: a remark that may be extended to all rivers, and fully illustrated in the next basin beyond the Merrimack.

Piscataqua basin is semi-circled on the south, south-west, west, and north-west by that of Merrimack, and north and north-east by that of Saco. It is formed by a series of short, but bold streams, which are discharged into a real lake, called Great Bay, the discharge of which into the Atlantic Ocean, at Portsmouth, is the real Piscataqua. The basin, only 40 by 25 miles, gains immense importance from the fine harbour of Portsmouth.

Saco river, the principal drain of the White Mountains, with the small river Kennebunk, forms a basin to the north-eastward from those of Piscataqua and Merrimack; south, from the Upper Androscoggin; and south-west, from the basin of Casco or Presumpscut. Saco is formed by two unequal branches, Saco Proper and Ossipee rivers.

Saco, fed by the almost perennial snows of the White Mountains, derives its higher sources from an elevation of from 3000 to perhaps 6000 feet, and pours its rapid current, by a very tortuous channel, to the south-eastward, 60 miles, by comparative distances, to its union with the Ossipee from the westward. Ossipee, the product of innumerable ponds, lakes, and small creeks, heading with the confluents of Squam and Winnipisseogee lakes, joins Saco, after a comparative course of 30 miles to the eastward. Below the junction of its two main branches, Saco flows, by comparative courses, 30 miles south-eastward, to its final discharge into the Atlantic Ocean, at North Lat. 43° 36′. The basin of Saco approaches the form of a parallelogram of 70 miles by 25, area 1750 square miles. The surface is a rapidly ascending inclined plane, since though the ocean tides are 18 or 20 feet at the outlet, they are arrested at Biddeford, only seven miles up the channel.

Casco Bay, a noble sheet of water, extending twenty miles from south-west to north-east, and from Portland harbour to within five miles from the Androscoggin at Brunswick, receives into the northern side of Portland harbour Presumpscut river from the north-westward. Presumpscut is the outlet of Sabago, and countless other smaller lakes, spreading between the basins of the Androscoggin and Saco. The basin approaches a triangle of fifty miles base; mean breadth 12, and area 600 square miles.

The four basins of Merrimack, Piscataqua, Saco, and Presumpscut occupy a physical section extending from 42° 2′ to 44° 18′ North, and lying between Lon. 4° 56′ and 6° 50′ East from W.C. Greatest length 150 miles, extending very nearly due north from the higher sources of Concord river to the extreme northern fountains of Saco; mean width 55 miles, and area 8350 square miles. This tract is remarkable for a wide rear towards Connecticut river, and a narrow front on the ocean; and from a much more important circumstance, the rapid rise of the ocean border, and, of course, the very short distance inland penetrated by the tides. The ports are all either directly on the ocean, or within from one to seven miles within the mouths of the bays or the rivers. If a general name was given to this physical section, taken from the the political subdivisions, it ought to be designated the basin of New Hampshire. It is, however, advancing on the course of our previous survey, followed by another natural section, which may be, with great propriety, called the basin of Maine. The latter, physically speaking, commences with Casco Bay. With an elliptic curve to the westward, the general course of the coast, in a distance of 140 miles, is very nearly from south to north, from Barnstable isthmus to Portland harbour. With Portland harbour, or what is the same, Casco Bay, the range and character of coast changes. From the Alatamaha to Casco, the indentings of the coast, with great variety, yet preserve some uniformity of structure; but with the latter begins a new order of bays and islands. The islands hitherto, in most instances, extend in length with that of the coast; along the basin of Maine, their position is directly the reverse. With salient points towards the ocean, the islands and peninsulas, with their intervening bays, spread a most intricate border from Portland to Quoddy Point: the two extremes bearing from each other N. 65° E., and the reverse, 181½ statute miles. It may be also remarked, that if the preceding course is continued it will follow the Bay of Fundy to its extreme head, nearly two hundred miles still farther beyond the mouth of St. Croix and the north-eastern limit of the United States. Were it not for what has been already noticed, the excessive tides, the access to the Maine basin from the ocean would be impeded to almost exclusion for three or four months of each year.

The United States section of this coast receives, beside many smaller streams, the large volumes formed by the union of Androscoggin and Kennebec, the Penobscot and St. Croix. On its northern part rise the numerous sources of the St. John's, the most considerable stream of the basin, but which has something more than one half of its entire course and its outlet in New Brunswick. As laid down on Tanner's United States, the mouth of Kennebec is at North Lat. 43° 44′, and the extreme source of Mattawasca at 48°, almost exactly. This gives an extent of 4¼ degrees of latitude.

The most extraordinary feature of this basin is, that along the higher sources of St. John's, in a distance of 140 statute miles, it is no place 35 miles distant from, and in one or two places approaches to within ten miles to the channel of St. Lawrence. The mean distance between the higher rim of the basin and the great river of Canada is about twenty miles, whilst the inclined plane towards the Atlantic has a width of 220 miles.

The particular basin of Kennebec has that of Presumpscut S.W.; Connecticut and St. Thomas W.; Chaudiere and the higher Penobscot N.; and the main extent of Penobscot to the N. and E.: extending in Lat. from 43° 44′ to 46° 15′ North, and in Lon. from 5° 40′ to 7° 50′ East from W.C.

The Androscoggin, or western branch of Kennebec, has its source in an intricacy of small rivers and lakes along the same chains, but on the opposite side from the sources of Connecticut. Flowing thence, a little S. of W. 70 miles, nearly parallel to, and 20 miles distant from the Connecticut, the Androscoggin abruptly bends to a little N. of E., and maintains the latter course 50 miles, where, reaching to within 25 miles from Kennebec, it inflects, and, by a sweeping curve to S.W., but a general course of S.E. 50 miles, joins the main stream 30 miles above its mouth into the ocean.

Kennebec has its extreme northern and principal source in Moose Head Lake, but that comparatively large sheet of water is only one of perhaps hundreds of smaller lakes which spread between the sources of Androscoggin and Penobscot, and opposite to those of Chaudiere. With many intermediate inflections, and receiving numerous confluents from both sides, the general course of Penobscot is from north to south, comparative length 140 miles above the influx of Androscoggin, and 30, thence to the ocean. The entire basin is in length 170, with a mean width of 60; area 10,200 square miles.

Though there is one channel called the Kennebec, it is very difficult to determine the real mouth of that stream. Estimating the distance from the outer capes, the tide ascends 35 miles up the Androscoggin to Durham, and 40 miles into the main Kennebec to Augusta. Above tide water, though from the great and rapid descent of their plane, both branches are incumbered with shoals and rapids, and are navigated downwards from near their respective sources.

Penobscot basin has that of Kennebec to the W., Chaudiere N.W., St. John's N. and N.E., and St. Croix E. The extreme higher sources of the Penobscot rise between those of St. John's and Kennebec, and opposite to those of Chaudiere. Flowing thence eastwardly 40 miles, it opens into a large lake, called Chesuncook, one of a congeries of lakes and creeks. With a greatly augmented current, the Penobscot issues from Chesuncook lake, and, inflecting to a course something east of south-east, and in some places swelling into lakes, and again contracting to a rapid river, maintains the latter direction, by comparative distances, 45 miles, to the entrance of Wattawamkeag river, from the north-east. The latter drains the space between the great bend of St. John's river, the head of St. Croix, and the Penobscot, where the latter makes its final inflexion to the southward. Immediately below the influx of Mattawamkeag, the course of the Penobscot is, however, for 25 miles to the S.S.W., to the entrance of the Piscataquis from the westward. The Piscataquis, usually regarded as the principal confluent of Penobscot, drains the space between Kennebec river, Moose Head Lake, Chesuncook Lake, and Penobscot river.

Below the mouth of Piscataquis the residue of the course of Penobscot is a little west of south, 90 miles to its ultimate entrance into the Atlantic Ocean, between the Fox Islands and St. George's Point, at N. Lat. 44°, and Lon. 8° E. from W.C.

The tide rises in the Penobscot 60 miles to Bangor, and thus far the stream is rather a bay than river. Above tide water the Penobscot, contrary to the general character of the Atlantic rivers of the United States, remains unimpeded by shoals or rapids, and though the basin is less extensive than that formed by the united streams of Androscoggin and Kennebec, it is much more navigable. The entire comparative length of Penobscot, from the source of the river to the outlet of the bay, is 215 miles.

Greatest length of the basin, in a very nearly north and south direction, 170 miles; mean breadth 50, and area 8500 square miles.

From the outlet of Penobscot bay to that of Passamaquoddy, in a N.E. by E. direction and 120 miles distance, though the coast remains very broken by salient points and deep intervening bays, no river enters, having its source 70 miles inland. Advancing from Penobscot, the principal bays are Blue Hill bay, Union river and bay, Frenchman's bay, Goldsboro bay, Pigeon Hill bay, Narraguagus river and bay, Pleasant river and bay, English bay, and Machias river and bay.

Machias bay is followed at a distance of 25 miles, by the deep indenting of Passamaquoddy bay; the entrance of St. Croix river and termination of the United States part of the Atlantic slope of North America. This remarkable political point is rendered easy of recollection geographically, as N. Lat. 45°, and Lon. 10° E. from W.C. intersect in the mouth of the Passamaquoddy.

St. Croix river gains most of its importance as a river, from being the boundary between the United States and New Brunswick. The entire length of the basin is about 80 miles; and the mean breadth of that part included in the United States, not more than 20 miles. The whole surface may be considered as a congeries of lakes and interlocking water courses.

If we include with that part of the St. Croix basin belonging to Maine, the maritime tract between the Penobscot and Passamaquoddy bays, we have a triangular space of 140 miles hypothenuse from the mouth of Penobscot to the source of St. Croix, and with a perpendicular from Passamaquoddy bay to the head of Schoodie lakes, 60 miles area; 4200 square miles.

With the preceding section, as we have already noticed, terminates that part of the extended Atlantic plain, included in the United States; but there remains an interior and very important natural section of 9500 square miles, formed physically by the upper valley of the basin of St. John's. This region, the object of political contention between the United States and Great Britain, has the basin of Penobscot south; that of Chaudiere S.W.; St. Lawrence W.N.W. and N., and the confluents of Chaleur bay N.E.

The extreme source of St. John's interlocks with the extreme source of Penobscot, and with the eastern confluents of Chaudiere, and at N. Lat. 46° 05'. From this elevated table land the St. John's flows N.N.W. 35 miles, directly towards the St. Lawrence, but deflected by the chain of high land which so closely skirts the latter, the former turns to S.E. and the two rivers flow in that direction 50 miles, distant about 40 miles asunder. Curving to the east 20 miles, the St. John's receives the Alaguash from the south, and four or five miles lower down, the St. François from the north.

Alaguash river has interlocking sources with the confluents of Chesuncook lake, and flowing thence a little E. of N. 70 miles, joins the St. John's, which it nearly equals in volume, at N. Lat. 47° 03', and Lon. 8° E. from W.C. The extreme northern sources of St. François rise within 10 miles from the channel of St. Lawrence; but flowing southward fall into St. John's, which latter, after the reception of those confluents, assumes a course of N.E. by E. 35 miles, to the influx of the important Mattawaska. The higher and most northern fountains of Mattawaska are also the extreme northern sources of the St. John's, and the most northern water which finds a recipient in the Atlantic slope, south-west from the peninsula of Nova Scotia. Similar to almost every other stream of the natural section to which it belongs, the Mattawaska is the drain of numerous lakes, the principal of which is the Temiscouata. The general course of Mattawaska is to the S.E., and comparative length, 65 miles.

Having received the Mattawaska, the St. John's inflects to a south-eastern course, which it maintains by comparative distances, 55 miles; at the end of 40 miles of which latter course this now large river quits the state of Maine and enters New Brunswick. The future course of St. John's is irrelevant to this article, except to notice the valley of Aroostook, a river having most of its confluents in Maine, but joining the St. John's in New Brunswick. Nearly on N. Lat. 47°, the St. John's bends to a course very little E. of S., slowly receding from the line between Maine and New Brunswick, in a comparative distance of 70 miles; bringing the volume of St. John's back to the latitude of the sources of Alaguash, and at a distance asunder of 90 miles. From the preceding description it is shown, that the Alaguash and St. John's, from the source of the former to the bottom of the great southern course of the latter, form an immense elliptical curve of 230 miles outline, and with a mean width of 70 miles. From the southern chord flow the northern fountains of Penobscot, and the interior part is chiefly drained by the Aroostook, which, flowing generally to the south-eastward, quits Maine and unites with St. John's in the western part of New Brunswick.

We have been the more particular with this superior part of the basin of St. John's, from its constituting the surface in issue between the United States and Great Britain. The British Commissioners contend that the High Lands mentioned in the Treaty of 1783, was the inflected line of separation between the higher sources of Penobscot and St. John's. On the contrary, the United States contend that after leaving the extreme northern source of the St. Croix, the line of demarcation between Maine and New Brunswick ought to extend due north until it reaches the dividing ridge between the confluents of St. Lawrence, and those entering the Atlantic Ocean. To enable the reader, without further reference, to compare the words of the

Treaty of 1783, with a good map of the disputed territory, we insert the clause designating this part of the common boundary between the United States and the British North American possessions.

"Art. 2. The following are and shall be their boundaries, viz.—From the north-west angle of Nova Scotia, viz. that angle which is formed by a line drawn due north from the source of St. Croix river to the Highlands; along the said Highlands which divide those rivers which empty themselves into the river St. Lawrence, from those which fall into the Atlantic Ocean, to the north-westernmost head of Connecticut river."—xx.

We have completed a rapid survey of the Atlantic slope of the United States, from the basin of Alatamaha to St. Croix inclusive, and on the strict geographical principles by which we have thus far proceeded, shall now proceed to insert the tables of relative height, between the basins of Susquehannah, Delaware, Hudson, Connecticut, the Massachusetts, and Maine basins, with those of Ohio and St. Lawrence. For the physical view of the great basins of St. Lawrence and Mississippi, the reader is referred to our several articles, Mississippi, Missouri, Navigation Inland, Ohio, Tennessee, &c.*

The physical view of the peninsula of Florida and its connecting slope, will be found after Table XVII. In some respects Florida would seem as a natural section, a part of the Atlantic slope, and so it is; but in climate, soil and position, that peninsula assimilates most directly with the Appalachicola, and Mobile basins.

†TABLE XII.

Ascents and Descents from Tide Water in Delaware River at Philadelphia to the city of Pittsburgh, by the route of the Columbia Rail Road, and thence by that of the Union Canal.

Route.	Distance in Miles.		Ascent or Descent.	Elevation in Feet above tide water.	
From tide water in the Schuylkill near the city of Philadelphia to head of Inclined Plane,		3½	rises.		189
Valley Hill in Chester county,	18	21½	"	314	503
Brandywine creek at Downingstown,	8½	30	falls.	343	160
Middle Ridge, or Mine Ridge,	18	48	rises.	439	599
Lancaster city,	18¾	66¾	falls.	250	349
Mount Pleasant,	8	74¾	rises.	94	443
Columbia, on Susquehannah,	8	82¾	falls.	217	226
Middletown,	18¼	101	rises.	50	276
Harrisburg,	8	109	"	10	286
Mouth of Juniata,	16	125	"	94	380
Lewistown,	44	169	"	60	440
Huntingdon,	45	214	"	294	734
Frankstown,	42	256	"	176	910
Summit of Allegheny Mountain,	19	275	"	1381	2291
North Branch of Conemaugh,	14½	289½	falls.	735	1556
Johnstown,	17½	307	"	402	1154
Blairsville,	29	336	"	241	913
Kiskiminitas river, mouth,	51	387	"	123	790
Pittsburgh,	30	417	"	112	678

‡TABLE XIII.

Ascents and Descents of the Schuylkill Navigation to Reading; and thence along the Union Canal to the Susquehannah at Middletown.

Route.	Distance in Miles.		Ascent or Descent	Elevation in Feet above tide water.	
Fair Mount Dam,					
Norristown,		16	rises.		53
Phœnixville,	16	32	"	7	60
Pottstown,	11	43	"	80	140
Unionville,	3	46	"	20	160
Birdsborough,	7	53	"	10	170
Where Canal leaves Schuylkill below Reading,	9	62	"	8	178
Bernville,	18	80	"	112	290
Womelsdorf,	11	91	"	70	360
Meyerstown,	8	99	"	80	440
Lebanon,	7	106	"	40	480
Palmyra,	18	124	falls.	135	345
Middletown,	18	142	"	69	276

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* The reader will observe that a physical view of the Atlantic slope is inserted in article Navigation Inland, and again under the article United States: the reasons which induced the repetition were, first, the greatly more accurate maps of that section which we now possess, than we did 10 years since; and secondly, the very great importance of the canals and roads erected and erecting, demanded the connected insertion of all information obtainable up to the publication of the article United States. These remarks will serve to explain the cause of discrepancies between the two descriptions.

† It ought to be observed, that in these tables the distances are not always determined to exactness, as they are frequently measured from maps; but as the tables are formed for the purpose of giving general ideas of the relative elevations of the country they respectively represent, fractional accuracy in distances is not so very requisite; and the more, as the routes do not entirely comply with those of the canals or roads.

‡ The distances in Table XIII., being measured from a scale, may not be minutely exact, but it is probable do not materially depart from the real stationary distances. To gain an accurate idea of the arable surface of the adjacent country, from 100 to 200 or more feet must be added to the height of the Schuylkill and Union Canal.—Pottsville, at the coal mines, is, according to Armroyd, 620 feet above tide water.

*TABLE XIV.

Ascents and Descents from Philadelphia to the level of Lake Erie, by the route of the Columbia Rail Road, valley of Susquehannah, to Elmira on Chemung River, and thence to intersect the Erie Canal at Montezuma, and along that canal to Buffalo on Lake Erie.

Route.	Distance in Miles.		Ascent or Descent.	Elevation in Feet above tide water.	
Susquehannah river at Columbia,		82¼	rises.		226
Susquehannah river at Duncan's Island nearly opposite the mouth of Juniata,	42¼	125		154	380
Northumberland, borough of, or the confluence of the two main branches of Susquehannah river,	39	164		86	466
Nantikoke falls,	54	218		77	543
Wilkesbarre,	8	226		28	571
Tioga Point, at the confluence of the East Branch of Susquehannah with the Chemung or Tioga river,	101	327		232	803
Elmira or Newtown on Tioga river,	20	347		51	854
Summit level between Tioga river at Newtown and the surface of Seneca Lake,	7	354		59	913
Outlet of Seneca Lake,	48	402	falls.	445	468
Montezuma, or the level of the Erie Canal at,	20	422		79	389
Rochester,	63	485	rises.	117	506
Lockport, where the Erie level is attained,	65	550	"	62	568
Buffalo, on Lake Erie,	31	581			

†TABLE XV.

Ascents and Descents from the level of Tide Water in Boston harbour to the level of Lake Erie, by the route of the intended Massachusetts Rail Road from Boston to Albany, and thence by the route of the Erie Canal.

Route.	Distance in Miles.		Ascent or Descent.	Elevation in Feet above tide water.	
Boston to Charles river,		10	rises.		32
Beaverdam brook,	8	18	"	112	144
Concord river,	10	28	"	116	260
Cutler's summit,	6	34	"	180	440
WORCESTER, Blackstone Canal at,	8	42	"	4	444
Jones's Ridge,	3	45	"	206	650
Henshaw's Ridge,	2	47	"	182	832
Livermore's Ridge,	2	49	"	18	850
Summit of the chain from which flows the Nashua into Merrimack, Blackstone into Narragansett Bay, and Chickapee into Connecticut river,	4	53	"	68	918
Chickapee river,	23	76	falls.	325	593
Shearer's summit,	6	82	"	224	369
CONNECTICUT river at Springfield,	13	95	"	330	39
Canal,			rises.	103	142
Westfield river,	13	108	"	20	162
Watton's,	10	118		312	474
Westfield river, again,	10	128		573	1047
Mount Washington summit,	7	135		433	1480
Houssatonick river,	12	147	falls.	435	945
Pittsfield on Houssatonick and in Berkshire county,	2	149	rises.	55	1000
Shaker's Millpond,	2	151	"	93	1093
Summit of Blue Ridge,	3	154	"	37	1130

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* Tables XII. and XIII. are in common from the tide level in Delaware and Schuylkill, to the mouth of Juniata river; and Table XII. meets Table XI. at Pittsburgh.

† Table XIV. intersects the route of Table XIII. at Montezuma, and the two tables are common thence to Buffalo. To compare either of those tables with the level of Lake Ontario, it is only necessary to know, that the latter sheet of water spreads 231 feet above mid-tide in the Atlantic Ocean; and, by reference, we find the lowest part of either Tables XIII. or XIV., between Utica level and Lake Erie, is 389 feet, at Montezuma. The lowest part, therefore, of that part of the Erie Canal which lies in the Canadian basin, rises 158 feet above the surface of Lake Ontario.

It ought to be also carefully observed, that both routes pass the respective chains of mountains by deep valleys or gaps. In the great range from the Catskill group, advancing westward three hundred miles to Lake Erie, along the table land from which flow, to the southward, the confluents of Delaware, Susquehannah, and Alleghany; and northward, those of Mohawk, Onondaga, Genesee, and Cattaraugus; the mean arable elevation is at least 1000 feet above tide water. Again, that natural section which forms the north-western part of New York is also, in its interior, an elevated table land, discharging streams with great rapidity of descent on all sides: but between the two table lands separated by the Mohawk there exists a very marked distinction of character. Of nearly equal elevation above tide water, if the mere mountain ridges are excepted, the table land to the south has no lakes of consequence, and not more than three or four of any kind, whilst that beyond the Mohawk to the north is a congeries of lakes or high marshy flats. Passing farther westward into the basin of Ontario, lakes of large comparative extent follow each other at small intervals; whilst directly south of this chain of lakes, the higher sources of Susquehannah issue from deep valleys, but no lakes exist.

With the basin of St. Lawrence, therefore, west of the basins of Connecticut and Hudson, commences the lake section of North America. It is only from due attention to those great contrasts of feature, and rapid changes of relative height, that the quick and otherwise unaccountable rise of temperature frequently found in a short advance from south to north, can be explained on the operation of natural laws.

Table XV. continued.

Route.	Distance in Miles.		Ascent or Descent.	Elevation in Feet above tide water.	
Boundary between New York and Massachusetts,	6	160	falls.	206	924
Parson's Tavern,	4	164	"	47	877
Dorr's,	7	171	"	347	530
Kinderhook creek,	5	176	"	7	267
Jacks,	9	185	"	6	273
ALBANY,	13	198	"	273	000
Thence, along Erie Canal, to head of Cahoos Falls,	12	210	rises.	185	185
Schenectady,	16	226	"	42	227
Plattekill Aqueduct,	5	231	"	16	243
Schoharie river,	17	248	"	48	291
Canajoharie creek,	17	265	"	6	297
Little Falls, bottom of,	18	283	"	63	360
German Flats,	7	290	"	25	385
Utica,	16	306	"	40	425
Along Utica level to Syracuse,	62	368	falls.	26	399
MONTEZUMA,	34	402	"	10	389
Palmyra,	34	436	rises.	52	441
Rochester,	29	465	"	65	506
Lockport on Erie level,	65	530	"	62	568
Buffalo on Lake Erie,	31	561	"	00	568

TABLE XVI.

Ascents and Descents from tide water in the Hudson to the St. Lawrence river at the mouth of Richelieu river, by the route of the New York Champlain Canal, Lake Champlain, and the Sorel or Richelieu river.

Route.	Distance in Miles.		Ascent or Descent.	Elevation in Feet above mid-tide.	
From level of tide in the Hudson to junction with Erie Canal,		8	rises.		48
Mechanicsville, at the mouth of Anthony's Hill,	10	18	"	44½	92½
Schuylersville at the mouth of Saratoga or Fish creek,	16	34	"	9	101½
Fort Edw'd Falls, route reaches the summit level, and leaves the Hudson,	14	48	"	46	147½
Fort Ann on Wood creek, northern end of summit level,	23½	71½	"	00	147½
Lake Champlain, surface of,	½	72	falls.	57	90½
Lake Champlain, outlet of,	104	176	"	00	90½

Table XVI. continued.

Route.	Distance in Miles.		Ascent or Descent.	Elevation in Feet above mid-tide.	
William Henry, town of, and outlet of Richelieu river into the head of Lake St. Peter,	70	246	falls.	80	10½
Tide water in St. Lawrence,	36	282	"	10½	00

TABLE XVII.

Ascents and Descents from the level of Tide Water in Connecticut River; thence, up along its channel, to the mouth of Passumpsic; thence, with the channel of the latter, to its source; over the summit level, and down Willoughby river, into Lake Memphramagog; through the latter, and its outlet, into St. Francis river, and down the latter to its influx into the channel of St. Lawrence, or, as there named, Lake St. Peter.

Route.	Distance in Miles.		Ascent or Descent.	Elevation in Feet above mid-tide.	
Springfield opposite the mouth of Westfield river, and where the Massachusetts Rail Road is intended to pass,		25	rises.		39
Mouth of Miller's river,	45	70	"	34	73
Mouth of White river,	100	170	"	261	334
Junction of Connecticut and Passumpsic rivers,	50	220	"	347	420
Summit level between the sources of Passumpsic and Willoughby rivers,	40	260	"	755	1175
Memphramagog, Lake	25	285	falls.	523	652
Do., outlet of, into St. Francis river,	55	340	"	210	442
St. Francis, influx of. into Lake St. Peter,	100	440	"	432	10
Three Rivers, town of, head of tide water in St. Lawrence,	28	468	"	10	00

The routes of Tables XV. and XVI. extend in a general approach to parallelism; the mean distance asunder is about sixty miles, though towards the northern extremity they approach each other and terminate almost at the same point in Lake St. Peter. The peculiar structure and inclination of the intervening region is seen by comparing the respective elevations. We discover that the channel of Connecticut river, to the northwards of tide water in the Hudson, is elevated 273 feet above the New York Champlain Canal, and 329 feet above Lake

Champlain; and also, that the latter lake is depressed 561½ feet below the level of Lake Memphramagog.

These relative heights are independent of the descent of Connecticut river above the influx of Passumpsic, which we have already shown is upwards of 1800 feet above tide water. An inclined plane therefore exists, and of about 100 miles breadth, and 1700 feet fall, from the chain which separates the sources of Androscoggin from those of Connecticut river. This plane is cut by the deep valley of the latter stream, rises again rapidly to the summits of the Vermont mountains, and finally depresses to within ninety feet of tide level at the eastern margin of Lake Champlain.

Tables XIV., XV., and XVI. show the very great inequality of surface in the north-eastern section of the United States, and by not including the extreme height of the mountains, exhibit the inflexions of the arable surface.

We now proceed to close these tables of relative elevations, by giving that of the Ohio Canal.

*TABLE XVIII.

Ascents and Descents from the Ohio River at the mouth of the Great Kenhawa; thence down the former to the influx of Scioto River; and thence, following the route of the Ohio Canal, to Lake Erie at the mouth of Cayahoga River and the village of Cleaveland.

Route.	Distance in Miles.		Ascent or Descent.	Elevation in Feet above mid-tide.	
Elevation of the Ohio at the mouth of Great Kenhawa,					535
Thence to mouth of Scioto,		85	falls.	61	474
Chillicothe,	52	137	rises.	140	614
Circleville,	20	157	"	60	674
Hebron on Licking summit,	52	209	"	219	893
Newark, county seat of Licking county,	10	219	falls.	69	834
Muskingum valley on the border between Muskingum and Conhocton counties,			"	90	744
Conhocton, village of,	42	261	rises.	24	768
New Philadelphia,	43	304	"	106	874
Masillon, in Stark county,	28	332	"	68	942
Akron in Portage county, northern extremity of Portage sum.	28	360	"	31	973
Cayahoga aqueduct,	13	373	falls.	269	704
Cleaveland, level of L. Erie at,	18	391	"	136	568

The reader will find by referring to our articles Mississippi, Missouri, Ohio, Navigation Inland, Vol. XIV. from page 315 to 409, and taken in connexion with article Tennessee River, a rather detailed view of the physical features of the great central valley of North America between the Gulf of Mexico and Canadian sea, including the latter under the name of the basin of St. Lawrence. At the time, 1822, that the article Navigation Inland was compiled, Florida was a recent acquisition, and the peninsular part very defectively explored. We have it now in our power, to close this physical view of that part of the territory of the United States E. of the Rocky or Chippewayan system of mountains, by a brief survey of the slope and peninsula of Florida. Within this physical section, however, considerably more territory is included than is embraced by the political term Florida.

If we glance over a map of the United States, and commence our view with the extreme southern point of Florida, we see the narrow commencement of two slopes or systems of rivers. That to the eastward, or in the supposed position on the right, is the extreme southern extension of the vast Atlantic inclined plane of the United States. Commencing with N. Lat. 25°, and skirting the Atlantic Ocean near 500 miles, with a mean breadth inland of about 70 miles, and in no place 120 miles, this confined selvedge is drained by St. John's, Nassau, St. Mary's, and Santilla rivers, with numerous mere creeks of the ocean; and rapidly widens with the basin of Alatamaha.

Of the series of rivers in the Florida part of the Atlantic slope, the most important are St. Mary's and St. John's.

St. Mary's basin, even when including the small adjoining basin of Nassau, is only 60 by 35 miles; area 2100 square miles; but the importance of this section arises from the great depth of water in the mouth of the former, admitting the entrance of the largest ships of war. This entrance is between Amelia and Cumberland islands at N. Lat. 30° 42′, Lon. 4° 37′ W. from W.C., and is remarkable as being the deepest and safest haven on the coast of the United States, perhaps of North America, south-west from the mouth of Chesapeake bay. The interior country does not, however, correspond to the noble harbour which connects it with the Atlantic Ocean; but should the proposed canal of connexion between the Atlantic Ocean and Gulf of Mexico, and which is to leave tide water at the town of St. Mary's, be ever effected, then will the deep channel of St. Mary's river give existence to an immense commercial mart.

St. John's, in the common meaning of the term, can hardly be called a river. It is rather a series of ponds or narrow lakes than a river, and flowing parallel or nearly so, to the opposing Atlantic coast, has all the essential properties of other lagoons along the same ocean shore. The outer bar affords only 15 feet water, a depth maintained, if not increased, 130 miles to Lake George. The latter 18 miles by 12, has 12 feet water; and that depth is again sustained 30 or 40 miles farther south, to where this singular water course has its origin in inundated flats. The course of St. John's is about N.N.W. with one rather comparatively large confluent, the Ocklawaha from the west. This tributary comes in below Lake George, and drains the space of grassy plains between the sources of Survanne and Amasura rivers, and as reported by some persons, the salt water of the Gulf of Mexico has been thrown by violent storms over the intermediate space into the St. John.

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* Of the distance included in Table XVII., 306 miles are included in the Ohio and Erie Canal. It ought to be noted also, that as some of the distances and elevations were measured from the scale in Armroyd's profile, they may not agree minutely with the actual measurements. That part of Ohio river between the mouths of Great Kenhawa and Scioto was included in this table, in order to connect the relative elevations on both sides of Ohio river.

Returning to Cape Sable, or the southern point of Florida, and carrying our view along the eastern shore of the Gulf of Mexico, we perceive the western slope of the peninsula wider than the eastern, and from the former issuing Shark's, Young, Sallivan's, Coolasahatchie, Charlotte's, Tampa and Amasura, in a distance of 350 miles. The mouth of St. John's on the east, and Vacasausa bay on the west, are usually regarded as the limits of the peninsula of Florida, but it is difficult to fix unexceptionable bounds to what nature has left vague. With the entrance of Suwanee river into the northern side of Vacasausa bay, commences a rapid and wide extension of the Florida basin, and the eye sweeps over in succession the sub-basins of Suwanee, Ocklockonne, Appalachicola, Choctawhatche, Conecuh, Mobile, Pascagonla and Pearl. On strict physical principles the Mississippi itself belongs to this system of rivers; but that great stream and its confluents are already noticed under their appropriate heads. The estuary of the Mobile affords also a very natural termination to the Florida basin;* though by the changes and restrictions of political terms, the latter basin no longer *debouches* in any part of political Florida.

Embracing the area drained by the rivers entering the Gulf of Mexico, from Florida Point to the Mobile, including the whole basin of the latter, the Florida basin extends 850 miles in a direction from south-east to north-west. For the first half of that distance, including the rivers of the peninsula with the Suwanee, the mean breadth is about 70 miles, and the area falls short of 30,000 square miles. This long narrow strip is followed by a section comprising the sub-basins of Appalachicola and Mobile, with the smaller intervening and adjacent basins, and containing 74,800 square miles; of which great extent Mobile embraces 37,000, and Appalachicola 12,800 square miles.

The whole basin of Western Florida extends in Lat. from 25° to 35° 05′ N., and in Lon. from 3° 50′ to 12° 30′ W. from W.C. In relative height, the extremes it is probable exceed 1800 feet; or the country giving source to the Coosa river, differs in temperature, arising from greater elevation, from four to five degrees Fahrenheit over the sandy or marshy plains of southern Florida.

Along this coast, following the inflexions without entering the bays, in a distance of 700 miles, the water is generally shallow. There are havens in Chatham bay, Charlotte river, Tampa bay, Vacasausa bay, Suwanee, St. Mark, estuary of Appalachicola, in St. Andrews, Pensacola and Mobile bays. Of these, the entrance of Pensacola with 22 feet water, is the deepest. The others vary from 12 down to three feet. Of the entrances to the interior, those of Mobile and Appalachicola are the most important. A projected canal over the northern part of the peninsula will be noticed in the sequel of this article.

We close this physical survey of the United States by resuming and completing our view of the canals and roads. The Chesapeake and Ohio canal has been noticed, and its ascents and descents given in Table II.

The Chesapeake bay is an immense reservoir, receiving into its capacious bosom the discharge of rivers presenting natural channels affording more or less facility to navigation. But the approach of the two bays of Chesapeake and Delaware, suggested at an early age of settlement a canal of connexion. Similar to that part of the Erie canal of New York, now forming the Utica level, the first idea of uniting the Delaware and Chesapeake bays by a navigable canal, must have been excited in the mind of the first intelligent person who became acquainted with the intermediate country. "It has been affirmed," says Armroyd, "that as early as 1762, David Rittenhouse, the celebrated astronomer, and at or about the same time, Dr. William Smith, Provost of the University of Pennsylvania, effected a survey or surveys, and levelled a route for a canal, to connect the waters of the Susquehannah and Schuylkill rivers by the Swatara and Tulpehocken," &c.

In 1767, or the following year, the canal system of the United States may be said to have commenced, by the surveys made by Thomas Gilpin and others for a canal from Duck creek to the head of Chester. In 1769, this project was further discussed, as were also the routes from Bohemia to Appoquinimink, and by the Christiana and Elk rivers. Had the state of society been mature for such designs as early as 1769, the revolutionary war would have arrested their execution; and when that war terminated, want of moral and political cohesion in its parts, want of foreign, and still worse, domestic commerce, in the United States, were all adverse to any project on a large scale, and which also was in its nature different from the ordinary operations of society. With all these causes of rejection or delay in canal plans, two abortive attempts were made to unite the Delaware and Schuylkill. Finally, in 1801 the Chesapeake and

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* Some explanation of the political term Florida may be necessary. The Spaniards imposed the name of Florida on the southern part of what is now the Atlantic slope of the United States, early in the 16th century. The name in the revolutions of last century became limited to the peninsula extending to St. Mary's on the east, and stretching westward to the Mississippi, southward from N. Lat. 31°. In the still more recent revolutions by which the whole of Florida was absorbed in the United States, the name became restricted on the west by the Perdido river; and West Florida divided between the states of Mississippi, Louisiana and Alabama.

Delaware canal was commenced, and several miles of the feeder of the upper route (via. Wilmington) were finished: the work was then suspended for about twenty years, and in 1823 the present route was selected, and on the 5th of April 1824, was commenced. This great work was finished the 18th October 1829. Length of this canal from Bush creek, water of Chesapeake, to Delaware city, on Delaware Bay, 14 miles; 60 feet wide at surface, 36 at bottom, with 8 feet water. It has now been in operation a little above two years.

Next to the preceding, advancing up the Delaware basin, is the Union Canal, the title of which was taken from the incorporation, into one, of two former companies, chartered in 1791 and 1792; but if we regard the city of Philadelphia as a point of outlet, the Schuylkill navigation may be regarded as the commencement on tide water of the chain, of which the latter navigation, the Union Canal, and Pennsylvania Canal are the great links. The ascents and descents of these works, with their routes, as also the route and perpendicular inflections of the Columbia Rail Road, are given in Tables XII. and XIII., and in Table XIV. are given the connexion of the Pennsylvania Canal with the higher part of the basin of Susquehannah, and the farther connexion with the Canadian basin, by the Erie Canal of New York.

Of the Pennsylvania part of the preceding, the Schuylkill Navigation is in complete operation, not only to meet the Union Canal near Reading, but to Pottsville at the coal mines. This is a combined system of dams, slack water, and canal and lock navigation; distance about 108 miles, and rise of 620 feet from tide-water to Pottsville. This great work was commenced in 1792, and 240,000 dollars were expended on it before it was suspended. In 1815 a new company was organized, and a new route was selected; the work was recommenced in 1816, which was one year *prior* to the commencement of the New York Canal. The total sum which has been expended on the old and new work, including also Fairmount Dam and Canal, has been 3,060,000 dollars. This is the greatest work yet accomplished by the enterprise of any company in the United States.

Union Canal also completed, and in successful operation, leaves the Schuylkill near Reading, and following the valleys of Tulpehocken and Swatara, reaches the Susquehannah and joins the Pennsylvania canal at Middletown; length 80 miles.

The Pennsylvania Canal itself, commencing at Columbia, and uniting with the Union Canal at the mouth of Swatara, and thence traversing the basin of Susquehannah, the intervening mountains by a rail-road link, and going on to the head of Ohio river at the city of Pittsburg, may be viewed as the main junction navigation between the basin of Susquehannah and the Valley of Ohio. We may now speak of this immense work as complete, and as one of those stupendous undertakings involving expense which few European nations would have dared to encounter sixty years past, and as one of the many proofs afforded of a change in the thinking faculties of mankind on the means of applying their labour and resources.* Of this magnificent undertaking, that part from the junction with the Union Canal to Huntingdon on the Juniata, and from the city of Pittsburg to Johnstown is already navigated. The residue, as also the two rail-roads, are in progress, and will be in operation before the termination of the present year.

Other works entirely within or united with the western side of the Delaware basin, are also either completed and navigable, or in rapid advance towards becoming so.

Of these, the Lehigh Navigation is the only one altogether confined to the Delaware basin. This very important work is executed and owned by a chartered company, called "The Lehigh Coal and Navigation Company." The Mauch Chunk and Easton Canal is 46½ miles in length, the locks are 100 feet long and 22 broad, the canal is five feet deep, and is perhaps the best work of the kind in the Union; it was viewed and approved of by the state commissioners, as finished, January 1830, and is in full operation.

Mauch Chunk, the coal landing on the Lehigh, is 524 feet above tide-water, and 361 feet above the Delaware at Easton.

A plan of a canal of connexion between the Lehigh at Lausanne, two miles above Mauch Chunk and the Susquehannah at Nescopec, led to the incorporation of a company, on the 25th of March 1826, by the legislature of Pennsylvania. The practicability of this canal is rendered doubtful, if Armroyd has correctly stated the elevation of the intermediate summit level at 1325 feet.

A canal from the Delaware river at the foot of its lower falls and mouth of Assanpink, by the valleys of Assanpink and Millstone rivers to the Raritan, was amongst the early canal routes planned in the United States; a charter for the purpose was granted by New Jersey, 30th December 1824, and under certain limitations acceded to by Pennsylvania on the 6th April 1825.

Comparing the natural obstructions respectively opposed, we should have expected a canal from the

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* With all the apparent magnitude it has gained, the system of roads and canals in the United States with direct commercial views is in its infancy. Having lent my feeble aid to this system, no reader will deem it presumption when I endeavour to secure the only reward I ever expect or wish to directly receive. In the original designs of canals there are two routes inserted in Armroyd's Navigation, which, as far as I have learned, came first from me. The first was to extend the Erie Canal from Black Rock to Detroit, along the United States side of Lake Erie; the second was to extend a canal from Pittsburg to Louisville, along the Ohio river. To these I am bold enough to add another; that is, the practicability to deepen the channel of the Mississippi, and navigate ships of the line to New Orleans.

These were not designs made in the closet; they were conceived on the very ground they are to be effected; and on which they will be effected. The Union Canal passes over the very spot, where, fifty-six years past, I was born, and if, in the course of nature, I could be in existence only fifty more years, what too many will now consider visionary, I could view or contemplate amongst the great finished labours of man.

William Darby.

Delaware to the Raritan as the first work of that kind which would be carried over New Jersey, but such has not been the actual course of events. The Morris canal, from the Passaick river to the Delaware at Easton, passes over a summit level of 888 feet above tide-water. The greater part of this elevation is passed by means of inclined planes in lieu of locks; the boats used are 25 tons each. The engineer who directed the work was Major Douglass. It has been completed and is navigable, affording a channel of intercommunication between the Delaware and Lehigh and the Hudson at the city of New York. The Delaware and Raritan Canal is nearly finished, and will be navigable in the ensuing autumn: the canal is 75 feet wide, 7 deep, and 38½ miles long, exclusive of the navigable feeder.

The Delaware and Hudson Canal is again another great work, produced by the coal mines of Pennsylvania. This work unites with the Delaware near Carpenter's Point, and four miles above the mouth of Nevesink river, and also very near the extreme northern angle of New Jersey, at an elevation of 455 feet above tide water. From the Delaware it ascends 80 feet up the valley of Nevisink, and again falls 535 feet down the Rondout and Esopus creeks to tide-water at Eddyville on the Hudson, length 106 miles, including also the canal to Honesdale in Pennsylvania.

The Hudson and Delaware canal is continued by that of the Lackawaxen. The latter ascends the left bank of the Delaware river and in the state of New York to opposite the mouth of Lackawaxen river, rising, in a distance of 17 miles, 148 feet; crossing Delaware and ascending the Lackawaxen valley 36 miles, and rising 68 feet, attaining an entire elevation of 1271 feet above tide-water.

The two latter, if they can be termed two canals, open to the New York market the immense coal deposites on the Lackawanna river, and similar to the Schuylkill and Lehigh navigations, have been crowned by new towns rising amid what a very few years past was barren rocks and silent desolation. Honesdale and Carbondale, in the mountains of Wayne and Port Carbon, Port Clinton, and Pottsville, in the mountains of Schuylkill county, have risen indeed amid the rudest wastes, monuments of the rapid improvement of the state to which they belong and adorn.

Independent, however, of canals or roads, the channels of the eastern and central rivers of Pennsylvania, have demanded and received some share of attention. Four hundred and forty thousand dollars have been expended in improving the natural channels of the rivers in this state.

A canal commences at Bristol on the Delaware, 18 miles above Philadelphia, and with some slight exceptions extends along and near the right bank of that river 60 miles, and rising from tide-water 170 feet to meet the Lehigh navigation and Morris canal at Easton. Above Easton to Carpenter's Point, in a distance of upwards of 60 miles, the channel of the Delaware has been but little improved; a remark equally applicable to both its higher constituents above the influx of the Lackawaxen river.

It is needless to swell an article necessarily brief by noticing the numerous canals and locks designed, or even chartered, where no ostensible labour has been performed; but the great importance of the Susquehanna basin will justify attention to the projected canals along the different channels. Perhaps no river of equal magnitude ever more completely justified the expression of Mr Brindley, that rivers were made to feed canals, than the Susquehanna. Abundant in its volume of water, but flowing over a rocky bed, and wide channel, the natural facilities of navigation are attended with difficulty and danger. To remove or obviate these obstructions different works have been proposed and executed.

Port Deposite canal, to pass the lower falls, has been long since completed by the state of Maryland.

Conestoga canal, to render that small river navigable to Lancaster, was authorised by the legislature of Pennsylvania, 28th of March 1820; and an act of incorporation passed for the same purpose, the 3d of March 1825. It has been completed in the manner of a dam and slack-water navigation, length 18 miles and fall 70 feet.

Conewago canals, two and a half miles in length, to overcome a fall of 21 feet, similar to the works at Port Deposite, were erected to pass falls, and are now used chiefly to convey water to certain mills.

The Susquehanna, or Middle Division canal, leaves the main trunk of the Pennsylvania canal at Duncan's Island, nearly opposite the mouth of Juniata, and ascends the valley 39 miles and rising 86 feet to Northumberland; and thence to the New York state line above Tioga Point, rising 337 feet in 165 miles. See Table XIV.

West Branch Division leaves the Middle Division at Northumberland, and extends to Dunstown, rising 109 feet in 70 miles. On the two Divisions just mentioned, 143 miles have been finished, exclusive of the portions now in progress.

It is an observation equally applicable to roads and canals, that those directly uniting the east with the west have always succeeded to an extent far beyond those extending longitudinal to the Atlantic coast. From the Susquehanna to the Seneca lake in New York, a canal is in progress, and from Oswego, on the east branch of the same river, to Ithaca, on the Cayuga lake, a rail-road is in progress; a canal from the Chenango to the Erie canal has been commenced, the Champlain route being too peculiar in its elevation and other attendant circumstances to come into the comparison.

Our survey now brings us into the great basin of the Hudson, rendered as remarkable for the vast extent of its canals as for its peculiar natural features. The canals of this physical section have been so extensively noticed under the Art. Nav. Inland, Vol. XIV., from page 345 to 375, that we may refer to that part of the Encyclopædia and to tables XIV. and XVI. of the present vol., only noticing under the present head, important works executed since the Art. Nav. Inland was published.

Oswego canal was authorised by an act of the legislature of New York, the 25th April 1825, and has been navigable since 1829. It connects the Erie canal with Lake Ontario by Seneca and Onondago or Oswego river. It is a mixed navigation of 38 miles, composed of canals and dams.

Cayuga and Seneca canal was formed from the outlet of one of these lakes to the other. As every reader may not be fully acquainted with the topography of this part of New York, it may be necessary to state, that the two lakes of Seneca and Cayuga extend not far from north and south and of nearly equal length 36 miles. At their head or southern extremity they are 18 miles asunder, but gradually incline towards each other so as to leave between them an interval of only about nine miles. Both are discharged at the northern extremity. The route of the Seneca, the western and most elevated, bending to the eastward from the point of discharge about twelve miles, joins the outlet of Cayuga, and inflecting to northward nine miles is crossed by the Erie canal at Montezuma. Both lakes are deep and navigable, therefore, to open their bosoms to the Erie canal became an early object of attention, the instant the latter work was so far advanced as to secure its final completion. An act of the legislature of New York was passed 20th April 1821, directing the prosecution of the Cayuga and Seneca Canal, and early in 1829 it became navigable.

The connexion between the Seneca and Cayuga lakes by a navigable canal once effected, naturally suggested the Chenango Canal, to connect the Ontario and Susquehanna basins.

Many other branch canals have been projected to unite with the Erie canal, but as far as our information extends, the preceding is the only one in progress.

Passing the Hudson, we arrive at the great physical section of New England. Since the article Navigation Inland was published, though the subject of canals has excited very active interest, the general exertions have been made to meliorate natural channels. To the preceding observation, the execution of the Farmington and Blackstone canals are important exceptions.

Farmington canal was suggested by the peculiar structure of that part of Connecticut over which the canal has been constructed. In that part of this article describing Connecticut basin, we noticed the small basin of Wallingford, at the southern extremity of which stands the city of New Haven. Under the head of mountains we also noticed the chain which extends from New Haven northwards and reaching Connecticut river at Northampton in Massachusetts. To the westward of this chain extends a valley nearly parallel to, but considerably elevated above, the Connecticut river, and stretching from the plain of New Haven to Northampton. Farmington river rising in the south-east mountain flows S.S.E. about 40 miles until meeting with the New Haven chain, and inflected to the northwards by an acute angle. Flowing along the mountain chain 16 miles, the stream bends eastward, passes the mountain and falls into Connecticut river. As already stated, the mountain valley continues along the chain into Massachusetts. In the latter state it is traversed by Westfield river, and does not really terminate until reaching Deerfield, having a length of about 90 miles. Many parts of this mountain valley spread into alluvial plains with very slight declivity in any direction.

The legislature of Connecticut, as early as 1822, granted an act of incorporation to a company for the construction of a canal from tide water at New Haven, to the Massachusetts line, near Southwick; length near 50 miles, in direct distance. The work was commenced in September 1825. Armroyd says that "in the distance from Southwick to New Haven, about 50 miles, there will be required a ten feet lock for every three miles of canal, or nearly so." This would suppose an entire fall of 166⅔ feet, in 50 miles, or three feet per mile nearly.

The Farmington canal is in operation, and to be continued in Massachusetts by the Westfield and Northampton canal, and above the latter place is continued in the improvements of Connecticut river.

The latter channel is one of the most extended and important on the Atlantic slope of the United States, and in proportion to length and magnitude of obstruction has been very greatly improved. In table XVII., the rise of this river and Passumpsic are given, and under the head of Connecticut river itself, is shown the great and rapid ascent of the main stream above the influx of Passumpsic. Below the village of Barnet, at the junction of the Connecticut and Passumpsic, the river has been rendered navigable to tide water, but the works are not such in all places as to secure the full rise of the fine volume of water draining one of the most interesting basins on earth.

Several different routes of canals from both sides of the Connecticut river have been proposed, as links of connexion with the adjacent basins. Towards the Hudson, it has been proposed to carry a chain of canals and locks from the mouth of Miller's river to the city of Troy on the Hudson.

A second route from the same side has been traced, leaving Connecticut river at Windsor, in Vermont, and over the intermediate mountains to Lake Champlain, by Otter river, or by the Pultenay river to Lake Champlain, at Whitehall. Above the preceding, numerous other routes have been named and measured: the last of which is the Connecticut and Memphramagogue route, the ascents and descents of which may be seen by reference to Table XVII.

On the eastern or left side of the Connecticut basin, the most important canal work proposed, is that route designated by the Boston and Connecticut, or Chickapee canal. This latter was a link in a splendid design of uniting Boston harbour with the Erie and Champlain canals of New York. Though as first planned, this route received the name of Chickapee from an intention to pass by that river, the vested rights of the Blackstone Canal Company, and more exact surveys, induced the preference of the route by Miller's, Deerfield, and Hoosack rivers. Summit level between Boston harbour and Connecticut river, Ashburnham pond, elevated 1066 feet above low water in the harbour and 893 feet above the Connecticut river at the influx of Miller's river. These projects of canals have been abandoned.

In table XV. will be found the ascents and descents of a projected rail-road, to supersede the preceding canal. Indeed, recently, very few canals are projected in any section of the United States without meeting a counter rail-road project, and whilst the public mind remains in doubt which deserves the preference, the contest must operate against the advance of either. From this and many other causes no side canal has yet been undertaken, to connect the basin of the Connecticut with those adjacent on either side. A rail-road from the Connecticut to Boston will be commenced this year.

Blackstone Canal from the head of Narraganset bay at Providence, to Worcester in Massachusetts, length 45 miles, and rise 444 feet, is in full operation.

Beyond the Boston and Narraganset basins some of the rivers have been farther improved, since the Article NAVIGATION INLAND was written, but no large work of connexion between the sub-basins has been undertaken; we must therefore refer to Armroyd and the public prints, for notice of incipient projects, which merely point out the routes where it may be desirable or practicable to form a canal or road; and return to our survey of what has been performed.

What has been actually completed on the Atlantic slope, and in the cases of New York and Pennsylvania, the extensions made into the great Canadian basin by the former, and into the Ohio valley by the latter, may well excite astonishment, but if all things are considered and liberally compared, the two great canals of the state of Ohio are the most stupendous undertakings ever achieved on the face of nature by man. Forty years ago the writer of this article saw the ground now comprising that state a wilderness. It is only a few days past 40 years since the United States army was defeated by savages on the very section of this youthful state, where now an artificial canal is navigated. It is really difficult to avoid excursions of fancy on such a subject, but the nature of our subject forces us back to matters of fact.

The Ohio state canals were projected about 1823, and may now, 1831, be regarded as completed, or so nearly so, as to admit a notice admitting their completion.

The Miami canal commences at Cincinnati, and extends north-north-eastwardly along the valley of the Great Miami, a total distance of 67 miles. It passes the towns of Hamilton, Middletown, Franklin and Miamisburg to Dayton, the county seat of Montgomery county. This canal is in full operation, and it is in contemplation to extend it to Lake Erie by the valleys of Miami, Miglaize and Maumee rivers. To secure this latter extension, the Congress of the United States made a grant or grants of land to a large amount, conditioned that the Ohio canals be completed within seven years from 1828, or in 1835, and said canals to be and forever remain public high-ways, for the use of the government of the United States.

The route of the eastern Ohio canal, with its ascents and descents, is given in Table XVIII. By reference to the latter table it will be seen, that this canal commences on the Ohio river at Portsmouth, and at the mouth of Sciota river, and thence ascends the Sciota upwards of 70 miles, passing the towns of Piketon, Chillicothe and Circleville. It then, leaving the Sciota, pursues a course a little E. of N.E. to Conhocton, passing the towns of Hebron and Newark, and the summit level between the valleys of Sciota and Muskingum rivers. From Conhocton, the canal follows the valley of Tuscarawas about 100 miles to the summit level between the Ohio valley and basin of Erie. It thence finally falls rapidly 31 miles to the level of Lake Erie at Cleaveland. This great canal traverses the counties of Sciota, Pike, Ross, Pickaway, Franklin, Fairfield, Licking, Muskingum, Conhockton, Tuscarawas, Stark, Portage and Cayahoga, and may, in more than one important circumstance, be regarded as a continuation of the Erie canal. Both the Ohio canals are owned by the state.

Louisville and Portland Canal, to pass the rapids of Ohio on the Kentucky side of that stream, though a work of immense importance, is yet in itself to be classed with side canals. It may be certainly considered as the most astonishing contrast between the rivers in the basin of the Mississippi, and those on the Atlantic slope, the extreme rarity of natural obstructions in the channels of the former system of rivers, compared with the abundance of shoals, rapids and cataracts in the latter. But, amongst the rivers which compose the Mississippi system, the Ohio, with its two main constituents, the Monongahela and Alleghany, are remarkable for presenting in the Ohio itself 948 miles; and adding either of the two channels above Pittsburg, 1200 miles of a natural navigation with but one serious interruption.

The Rapids of Ohio are occasioned by a bed of limestone rock, over which the volume rolls down 22½ feet in little more than two miles. To pass these rocks by a canal must have been a suggestion coeval with the navigation of the Ohio, but to complete such a work demanded population and wealth. The latter seems, however, to have increased still more rapidly than the former. According to Armroyd, page 337, the Ohio tonnage in 1823, was 19,453, and in 1828, 50,000; an increment of 257 per cent in six years. Something may no doubt be allowed for more accurate registry, as the period advanced, but where the trade even doubled in six years, its increasing weight must of course sweep away the obstructions at the cataract near Louisville. The legislature of Kentucky granted a charter, January 1825, to "*The Louisville and Portland Canal Company*," with a capital stock of 600,000 dollars, one sixth part of which was taken by the United States under an act of Congress. The United States by a subsequent subscription increased the stock of the Company 150,000 dollars.*

From the 6th Annual Report of this Canal Company, it appears, that on the failure of the subscription expected from the United States, the Board negotiated a loan for 100,000 dollars, and a subsequent one for 30,000 dollars. Deducting certain property on hand, the Company now owe, therefore, about 130,000 dollars. It is known, that on the 1st of December 1830, the canal was opened; it was found to afford seven feet water throughout, being four feet more than on the falls. All the transactions of the past year have been adjusted with the contractors.

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* Armroyd, page 336–337.

The Engineer states in his communication to the Company:—

"That the experiments which have been made since the water was let into the canal by the passing of several boats, have furnished to my mind the fullest and most conclusive evidence, that the anticipations relative to the durability and utility of the work will be fully realised, and that the fears of those who, from the great and unusual width and height of the locks, have regarded it as a doubtful experiment, will be completely removed; and finally, that it is only necessary for the canal to be put into successful operation, to demonstrate its great and permanent usefulness to the community, and its peculiar and increasing value in a pecuniary point of view to the stockholders themselves."

In a postscript, January 3d, 1831, the Engineer says:—

"For the gratification of the stockholders, I will state, that the canal is now in operation, and that the following steam boats have passed since the date of the above Report: on the 1st inst. the steamboat Cavalier; on the 2d, the steamboat Cumberland; and on this day, the steamboats La Grange, Virginia, Gondola and Tippacanoe.*

The Ohio river above Louisville, we perceive by the foregoing notices, is open to, and connected with Lake Erie by the great canal of Ohio; a rapid advance is making to complete another connexion by the Alleghany constituent with the basins of Susquehannah and Delaware, and that by the completion of the Louisville and Portland Canal, the once formidable "*Falls of Ohio*," commercially speaking, will exist no more.

At the town of Beaver (situated at the mouth of the river of the same name), on the Ohio, a canal is in progress to the town of Erie on the lake, 166 miles; about 49 miles of the route in two detached parts, have been finished at the expense of the State of Pennsylvania. From the town of Meadville to Franklin, on the Alleghany, a branch of this canal is also in progress, and will perhaps be navigable in the course of the ensuing year.

With the Louisville and Portland Canal, terminate all works of the kind, of any consequence, deserving particular notice, which have been attempted in the valley of Ohio, or basin of the Mississippi. The small canal at New Orleans from Bayou St. John's to a basin in the rear of that city, is a local work of great utility, but a detailed notice is precluded by its limited extent, and the probability of its being in great part superseded by a lock and canal navigation through the city and bayou St. John into Lake Ponchartrain.

The Delta of the Mississippi is in a state of nature, a net-work of interlocking channels, all of which, and lakes of all dimensions, from a mere pond to the Pontchartrain 18 by 30 miles, are shallow, with the exception of the channels of the Mississippi and Red rivers. The deepest passes from the Delta into the Gulf of Mexico, at mid-tide, are 12 feet, and that depth only in the two main mouths of the Mississippi. The number of intermediate cuts, which the topography of such a country admits, are indefinite, and many of them if executed, would be of great local advantage: but leaving what must be remote and contingent, we may notice one practicable work, in which are concerned the whole commercial nations of America and Europe. That is the deepening and securing a permanent channel from the south-east mouth or main outlet of the Mississippi.

In 1813 the writer of this article made an actual survey, and took the soundings in the different mouths of the Mississippi, and found invariably that the water rapidly deepened outside of each bar. At the Main Pass, when a lead could be thrown on the bank, we had 30 feet water, and at a cable's length farther into the gulf, 70 feet. The bottom shoals more slowly inward and upwards, but at a mile above the bar the largest vessel can be floated. The idea of a work to remove the bar and admit ships of any draught, was natural, when once the given elements were known.

This work will immortalise some statesman, and is in itself of magnitude too immense as to its certain benefits, to be called merely national:—its execution would be an advantage to the civilized world.

To the deepening of the main outlet of the Mississippi, may be added as part of the same chain of improvement, the Florida canal. This work so national and so obviously necessary to shorten the distance and lessen the dangers of the coasting trade of the United States, must gain increasing attention until actually accomplished. On Tanner's map of the United States a line of this canal is projected from the town of St. Mary's, on the river of the same name, in a direction a little S. of W. to the mouth of Appalachicola. It may be doubted whether the intermediate space has been yet surveyed to an adequate extent, to the south of this route, to determine either its adoption or modification. There is another consideration which must excite doubts of the St. Mary's being the proper emporium on the Atlantic limit of such a canal. The least attainable depth of water must decide that necessary to the canal; and of course, if only 8 or 10 feet can be obtained for a harbour on the gulf side, there would be nothing gained, as far as the navigation of the canal is to be concerned, in a deeper harbour on the Atlantic. The proposed distance from St. Mary's to Appalachicola, is 250 miles, and where crossing the summit level between the Oscilla and Ocklockonee rivers, the rise is 217 feet above tide-water in the Atlantic Ocean.

On Tanner's map again, there is another canal route traced from the St. John's river, at Jacksonville, to Suwanee river. In length, the latter route is not half the distance of the former, nor can the intervening heights between St. John's and Suwanee, be near so great as they are between St. Mary's and Appalachicola rivers.

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* National Intelligencer, January 25th, 1831.

Independent of density of population and concentration of wealth on its route, a most careful and extended survey of the isthmus which unites the peninsula to the continent, is requisite to a proper location of the Florida canal. Such a survey ought to embrace a minute admeasurement of the depth of water along both coasts, but particularly along that of the Gulf of Mexico.

We have now brought our sketch round to the point of outset, and many readers of the Encyclopædia may discover important objects omitted, but it ought to be considered that our article is necessarily brief. In the composition of our view of canals, we have also omitted any insertion of either estimated or incurred expense. Our view being to give the reader a general view of the great canal works actually in operation, and glancing incidentally on those which are only designed, or in an incipient state. The fact is, that the advance of population and active enterprise is such, that the statistical writer has more than a daily task prepared, and no work on the geography of the United States, but must present voids in a few months after publication.

The following statements respecting the canals and rail-roads in the United States have been extracted from an essay written by George W. Smith, Philadelphia, 1832.

"The spirit of enterprise has been displayed on a scale commensurate with the extensive territory of the United States. With the exception of Great Britain and Holland, no country on the face of the globe contains as many or as extensive canals as this Republic; and the whole of combined Europe has not effected as much during the last 16 years as the three states of Pennsylvania, New York, and Ohio only. The total number of miles of canals in the Union is 2526 (*including* about 264 miles which are nearly finished, and which will be navigable during the ensuing spring). Several extensive canals are in progress, and an immense number of projected or authorised works are not included in the summary just given. Nearly four-fifths of the aggregate amount have been executed in the three states above mentioned.

"In a country where the science of civil engineering was scarcely known even by name but a few years since, many errors may of course be expected to exist in the plan and construction of works which require the most profound knowledge and extensive experience of the profession. Astonishment may, therefore, be expressed rather at the unusual measure of success which has attended the execution of many of these works, than at the failure and disappointment which have been so frequently experienced. Surveyors, millers, and judges, &c., have been converted into engineers with magic rapidity, assuming the title without previous study or practice; they have been entrusted with the expenditure of countless millions of dollars without any precaution but a reliance on their intuitive sagacity: knowledge has, indeed, been acquired during the progress of the works, but the expense of tuition has been enormous. In the mean time a new race of engineers has sprung up —men uniting the science of the scholar, and the skill which practice only can confer. Under their auspices a great improvement in the management and character of public works has already been manifested.

"* * * The geographical features of the United States have already been described, and their influence on the location of the canals in various parts of the country. As the rivers generally break *through* the ridges instead of flowing in the valleys after the European fashion—and as these ridges are very numerous and in a great degree parallel, this circumstance has confined canals to the vicinity of the rivers. An additional cause, the supply of a sufficient quantity of water, which can only be obtained from the larger streams, has rendered this course necessary. An evil of great magnitude is an unavoidable concomitant of such localities; the canals are often exposed to the violence of floods and ice freshets. This evil may sometimes be obviated or diminished by a judicious selection of sites; but in many cases skill is unavailing, and no alternative is presented but the conversion of rivers into canals, or rather slack-water pools, or the location of the canals on their margin. In either case, the puny structures of man are frequently unable to contend with the fury of the elements, and a few moments are sufficient to accomplish the destruction of works on which whole years of unremitted labour and the treasures of a nation have been expended. The damages which have been sustained by the canals in Pennsylvania alone, from the freshets of the present year, have been estimated at $450,000, in addition to the extensive and incalculable injury which will result from a suspension of the navigation during the many months which will elapse before the injury can be repaired.

"The locks, aqueducts, and other constituent parts of the American canals, are not constructed with the same regard for permanency which is observable in Europe. Wood is usually employed as a substitute for stone in the aqueducts (particularly those of large dimensions), waste weirs, bridges, and the foundation of the locks. Sometimes even the locks are wholly or in part built of timber. Inverted arches of masonry for foundations for the locks have been employed in perhaps not more than half a dozen locks in the Union—principally in Pennsylvania. The cheapness of timber has rendered the use of masonry in many cases inexpedient; and the substitution of the former material has diminished the cost of constructing public works, at the same time it has rendered them less durable and more subject to injury."

"The cost of the canals in the United States has *already* been about $21,400 on an average per mile. Although many expensive alterations have been made, a large additional sum will be requisite for the purpose of completing these works in a permanent and suitable manner. The amount necessary for this purpose cannot be accurately estimated; but, if a judgment may be formed from the brief and limited experience of New York and Pennsylvania (where much expenditure will still be necessary), the ultimate cost will probably be *at least* $28,500 *per mile*. The *navigable* canals of Pennsylvania have *already* cost $25,185 per mile."

"The cheapest canal (probably in the Union) cost about $5200 on an average per mile. (Fractions will be generally omitted in these estimates.)

"The Chesapeake and Delaware Canal cost nearly $169,000 per mile. The dimensions of this work permit the passage of coasters; of course the cost was greater than would be requisite for canals intended only for boats; the amount of excavation and embankment was much greater than usual. This work presents one of the cases where canals are decidedly superior to rail-roads—namely, for *connecting by a short line* an immense extent of navigable waters: although the tolls chargeable on every ton render the cost of *transportation* ten times greater than on a rail-road of similar extent, and constructed for perhaps one-tenth of the cost of the canal—nevertheless, the expense, delay, and inconvenience of *transhipment* give a preference to a work which permits a continuous voyage. A rival rail-road, to connect the same points, has, however, even in this instance, been made, and with great advantage, for the rapid conveyance of light goods, passengers, &c., for which purposes canals are not adapted."

"In the United States, the proprietors of the two thousand five hundred and twenty-five miles of canals, which are in operation or in progress, have not, *in any one solitary instance*, received from the tolls derived from these works the current interest of the country on the capital expended in their construction (including therein, as part of the real cost, *the arrears of unpaid interest on those portions of the capital which were temporarily dormant*). The Erie and Champlain Canals of New York (now the most productive in the Union,) *have not in any one year, with one exception, paid the expenses of their repairs and management, and the current rate of interest on their actual cost*, although in other respects they have greatly increased the wealth and welfare of that populous state.*

"Justice, however, requires the remark, that many of the *American* canals have only recently been constructed, and, consequently, that the trade on them is not yet established to the extent which time will create: on a *few* the navigation has not yet commenced. The trade will, undoubtedly, increase.

"Enormous additional sums, however, will be required to improve and strengthen the works on these highways; few of which are yet consolidated or *permanently finished*. The remark which has been made, that "Canals when first filled with water should be considered as scarcely half finished," applies with peculiar force to the flimsy and precarious precursors of more substantial works, which the impatience and inexperience of our citizens have caused to spring into existence with a celerity resembling the growth of a fragile mushroom—rapid but unsubstantial; manifesting symptoms of decay before even the appearance of maturity."

Notes on the Internal Improvement of Pennsylvania.

"In some parts of the Union a very erroneous opinion prevails, that the United States are indebted entirely to the example of New York for the active and beneficial spirit of internal improvement which at present pervades the whole confederacy.

"The splendid results which followed the execution of that stupendous work, the grand canal of New York, most powerfully attracted the attention and stimulated the exertions of other states; many works which had been commenced long prior to the date of that canal, ceased to languish, and acquired new life and vigour from the success of that splendid example. But the spirit of the age, the spirit of internal improvement, was already abroad; the attention of the people in many of the states, was directed to the improvement of the channels by which commercial intercouse was maintained. The difficulty and enormous expense of transportation on the roads of the country, had induced some of our statesmen, even before the revolution, to

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* The total cost of these canals, including the expense attending the repairs and alterations, has been nearly $12,000,000. The following table is an interesting document.

TOLLS ON NEW YORK CANALS.

The following is a comparative statement of the tolls collected upon the stated New York canals, in the years 1830 and 1831, up to the close of August in each year.

	Erie and Champlain Canal.				*Oswego Canal.*				*Cayuga and Seneca Canal.*		
	1830.	1831.	Gain.		1830.	1831.	Gain.		1830.	1831.	Gain.
April	$ 75,470	$116,300	$ 40,820	April	$ 750,13	$1180,20	$430,19	April	$956,60	$1214,19	$ 257,50
May	166,140	213,311	47,171	May	2058,95	2829,06	770,11	May	1905,79	2663,42	757,63
June	103,437	142,315	38,878	June	1455,88	2429,06	973,18	June	1556,43	1707,37	151,94
July	84,402	106,858	22,057	July	1238,10	1790,38	552,28	July	1095,10	1164,59	69,49
August	80,605	114,216	33,611	August	1101,09	1826,64	724,95	August	788,06	2219,36	431,30
	$510,404	$693,100	$182,696		$6664,15	$10,054,83	$3450,68		$6301,98	$7968,93	$1667,95

Gain upon the Erie and Champlain canals,	$182,696
Gain upon the Oswego canal,	3,450
Gain upon the Cayuga and Seneca canal, .	1,668
Total gain,	$187,814

turn their attention to canals as economical substitutes for land conveyance. The increasing commerce of the United States, after the revolution, soon demanded and obtained the commencement of these works in Carolina, Virginia, Maryland, Pennsylvania, New York, and Massachusetts. The events of the war of 1812—14, confirmed the statements of the advocates for canals. On examination of the period immediately succeeding the treaty of peace, we discover that many canals, &c. were commenced before the great work of New York

"It would lead us far beyond the prescribed limits if we should adduce facts in support of our statement from any other commonwealth than Pennsylvania: but within these limits we shall obtain abundant evidence.

"The splendour of one great enterprise in New York, appears to have almost eclipsed the brilliancy of the numerous achievements of the other states. Their magnitude and importance, although far greater in the aggregate, fail to make an equal impression on the imagination. Hence, although *Pennsylvania has expended several millions of dollars more on internal improvement than any state in the Union, and we believe more than any two states collectively*, and although the spirit of internal improvement first sprung into existence in that commonwealth (as we shall presently prove beyond all doubt), nevertheless, New York is erroneously supposed by many to be her birth place; the theatre of her earliest, as well as most vigorous exertions. The political supporters of a great statesman, sometime since deceased, not content with attributing to him the praise which he deserved, as the *late, but most efficient*, advocate for the introduction of canals—have vainly endeavoured to wrest from other and earlier labourers in the cause, the merit of *originating*, not only the great canal of New York, but of the system of internal improvement, a system which had been advocated, adopted, and actually commenced, long before the political birth of De Witt Clinton.

"In Pennsylvania party spirit has not been connected with internal improvements, hence her march, although rapid and constant, has been silent and unostentatious. If we except three of the almost uninhabited counties which are in the northwestern part of this state, five-sixths of every part of the commonwealth will be intersected by canals and rail ways, leaving *no point* at a greater distance from these highways than 23 miles, when the works *now in progress* shall be finished.

"Some interesting letters of William Penn, Logan, and other early statesmen of Pennsylvania, are extant, which contain much interesting information relating to the improvement of the roads, the structure of bridges, and the clearing of river channels in the province. The clear views, and above all, the peculiar foresight displayed in this correspondence, would amply repay the trouble of a perusal at the present day. William Penn, in his 'proposals for a second settlement in the province of Pennsylvania,' published in the year 1690,* alludes to the practicability of effecting a 'communication,' 'by water,' between the Susquehanna and a branch of the river Schuylkill. The extreme brevity of this paper will not authorise us to draw any satisfactory conclusion respecting the *mode* by which this communication was intended to be effected; but the tenor of his language, the infancy of his colony, the modes of commercial intercourse prevalent at that early period, will not allow us to suppose, that even the prophetic spirit of the founder of Pennsylvania foresaw, far less projected, the canal which was commenced exactly one century from the date of this remarkable letter. Canals and turnpikes were unknown at this period, even in Great Britain; we ought not, therefore, to expect to find them in Pennsylvania.

"Objects of more real importance at that period, claimed the attention, and exercised the wisdom and liberality of the provincial legislature; roads were then to be constructed through the primitive forests; marshes were to be rendered passable by causeways; and bridges to be thrown over the minor streams; rude indeed in their structure, but requiring all the enterprise, and all the financial resources of that early period. Bridging the Atlantic and bridging the Delaware and Susquehanna would have been deemed equally feasible projects by our ancestors. Many appropriations were made for the purpose of improving the navigation of the streams; but it was not until a later period that the subject of canals began to attract the attention of a few of our more intelligent citizens. Numerous letters are extant which are peculiarly interesting, not merely from the character of their writers, but for the perfect originality of the views contained in them. They prove beyond all possibility of doubt, that *the Union is indebted to Pennsylvania for the first introduction of canals and turnpikes to the public attention.*

"If Pennsylvania be justly liable to censure, it is not for her supineness and want of enterprize; it is not for her sins of *omission*, but of *commission.* She has done what she ought to have left undone; she exercised her energies prematurely; and abortive efforts were the result: she was in advance of the spirit of the age; and her example, in commencing the first canal to connect the eastern and western waters, which, if successful, would have stimulated other states to rivalry, proved by its failure a beacon which warned them to shun her course. We have already alluded to the correspondence of some of our citizens respecting the introduction of canals—their views were regarded at that early period (between the years 1750—60), with but little interest in England, and excited the attention of but few individuals in the colonies; nevertheless, to these remote efforts, the earliest projects of internal improvement in various portions of our country may be traced.

"At the present day it is difficult to determine to whom we are chiefly indebted for introducing the subject to the public attention. If our information be correct, we may attribute to David Rittenhouse, the astronomer, and to Dr. William Smith, provost of the University of Pennsylvania, the credit of being the first labourers in this hitherto untrodden field. Afterwards, Robert Morris, the financier of the revolution, and still later, Robert Fulton, the engineer, of whom Pennsylvania is so justly proud, lent their powerful assistance. To describe their efforts in detail, would require volumes.

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* See Register of Pennsylvania, June 28th, 1828.

"We have previously had occasion to notice the earliest efforts to introduce canals into the province; these efforts indicated more zeal than discretion. Schemes were proposed which, if not absolutely visionary, at least were impracticable at that period. It was proposed to execute canals in districts where, in consequence of the limited population, but little advantage could be received from them; consequently, some of their projects have never been executed, and it was reserved for posterity to attempt the fulfilment of others of their designs.

"In conformity to our plan, we will now give a detailed statement of several of the more important works already executed, in progress, or in contemplation—commencing with the Union Canal. We have already stated, that in the year 1762, David Rittenhouse and Dr. William Smith surveyed and levelled a route for a canal to connect the Susquehanna and Schuylkill rivers. The Union Canal, which has since accomplished this object, passes over a portion of this route; the first which was surveyed for a canal in the colonies.

"The views of the projectors of this work, were, if the difficulties of that period be considered, far more gigantic and surprising than have been entertained by their successors in any part of the Union. They contemplated nothing less than a junction of the eastern and western waters of Lake Erie and of the Ohio with the Delaware, on a route extending 582 miles. The Alleghany mountain intervening, presents an elevation of about 3000 feet above the tide, and was wisely deemed to offer an insuperable obstacle to a continuous navigation; a portage over this section was accordingly recommended (an expedient which, notwithstanding our present command of almost unlimited capital, and our improvements in engineering, we at the present day have been compelled to adopt). The greater portion of the remainder of the route was at first supposed to be sufficient for the purposes of navigation; if the channels were suitably improved by removing rocks and sand bars, building dams and using wing walls, and excavating canals at a few of the more difficult, or otherwise impassable sections; a scheme which their subsequent experience proved to be erroneous, and more extensive canals were projected.

"Duly to appreciate the enterprise of that age, we ought to consider that the great valley of the Ohio and Mississippi was almost one boundless forest; a wilderness inhabited only by wild beasts, or the scarcely less savage Indians; attainable moneyed capital was then almost unknown in the colonies, the very term 'engineering' was equally unknown in the vocabulary of those days. No canal was then in existence in England; Sankey Brook and the Duke of Bridgewater's had been commenced, but were yet unfinished. The public teachers even there, had yet to learn that canals were not visionary undertakings. The sneers of many even in the parliament of Great Britain were to be encountered; nevertheless, under all these discouragements, the earliest advocates for inland navigation commenced their efforts in Pennsylvania. In 1764, they induced the American Philosophical Society to order a survey for a canal to connect the Chesapeake bay with the Delaware. These laudable efforts were duly appreciated by the provincial legislature; which finally about the same period authorised a survey on a route extending 582 miles to Pittsburg and Erie. This survey was accordingly performed, and a report made, strongly recommending the execution of the project. The adoption of the plan was, however, postponed, in consequence of the more important concerns which occupied the public attention immediately before and during the revolution. After the glorious termination of that struggle, the spirit of internal improvement began to animate the citizens of other states, and several works were commenced in North Carolina, Virginia, and Maryland. The canal through the Dismal Swamp, connecting the Chesapeake bay, Albemarle Sound, with the works on the Potomac, James and Rappahannock rivers, were commenced and partially finished, between the years 1786 and 1791. But these works were all partial and incomplete; local in their benefit, and evincing little boldness or skill in their plans or execution.

"The great project of Pennsylvania had been allowed to slumber, but it was only to acquire fresh vigour by repose. It had not been forgotten nor relinquished. The time had now arrived to commence this gigantic enterprise; accordingly, on the 29th day of September, in the year 1791, the legislature incorporated a joint stock company to effect a portion of the plan. Robert Morris, David Rittenhouse, William Smith, Tench Francis, and others were named in the bill as commissioners. The company was authorised to connect the Susquehanna and Schuylkill, by a canal and slackwater navigation; and thus accomplish the first link in the great chain by which they intended eventually to connect Erie, Pittsburg, and Philadelphia.

"The intention of connecting the eastern with the western and northwestern parts of the state is distinctly expressed in this act, and in a subsequent act passed in the following year (April 10th, 1792). The policy of effecting such works by joint stock companies, assisted by legislative encouragement, is also distinctly stated; a policy combining the vigilance of private interest in the expenditure of money, with the ample and certain resources of the public treasury. All persons who are conversant with the history of public works throughout the world, will assent to the expediency of this plan: when the public is the sole paymaster, extravagance, imposition, and negligence are the almost inevitable consequences. In Great Britain and Ireland, where this subject has been thoroughly examined, every canal (with the exception of two, intended chiefly for military purposes) has been made by individuals or companies, who have been frequently assisted by parliamentary bounty.

"On the continent of Europe, where the opposite plan is usually pursued, the evils which we have previously mentioned, almost universally prevail. Baron Dupin, in his valuable treatise on the public works of Great Britain, most ably and convincingly describes these evils.

"The success which it is alleged has attended the execution of the grand canal by the state of New York, may perhaps be adduced in opposition to this opinion.

"But the exception is only apparent; the splendour of the result threw a veil over the many abuses which occurred during the prosecution of that work; some of these abuses are already known to the public, and doubtless many remained concealed. The same remark may be applied to many of the public works in various parts of the Union. The instances are extremely few in which the benefits necessarily resulting from this plan will so far counterbalance the evil, as to render necessary its adoption. The unassisted efforts of individuals when at once protected and restrained by judicious acts of incorporation, will be *usually* sufficient for the purpose of accomplishing such works of internal improvement, as the public welfare may really require. If such works should require the expenditure of larger sums than an incorporated company can procure, the public treasury may then be required to supply the deficiency. Such accordingly has been the policy of Pennsylvania. Until recently, nearly all the turnpike roads, bridges, canals, and rail ways in the state, were executed by chartered companies; the state frequently subscribing to the stock, or making liberal donations in aid of the projects.

"In some cases, where the commonwealth subscribed for too large a proportion of the stock, or incautiously advanced the funds, fraud and extravagance in the management were the almost inevitable consequences. We therefore deem it peculiarly fortunate, that, the preamble to the charter of the first companies authorised to make internal improvements, contains a distinct recognition of the principle for which we have been contending. As further investigation of this subject would occasion a digression from the immediate subject which we are engaged in examining, we will resume our description of the proceedings of the second company to which we have previously alluded, viz. the company incorporated the 10th of April 1792, to effect a junction of the Delaware with the Schuylkill river, by a canal extending from Norristown to Philadelphia; a distance of 17 miles. The Schuylkill river from the former city to Reading was to be *temporarily* improved: and thus form with the works of the Susquehanna and Schuylkill company, an uninterrupted water communication with the interior of the state; with the intention, as we have previously remarked, of extending the chain to Erie and Ohio. Experience soon convinced the two companies that a greater length of canal was requisite, in consequence of the difficulties of improving the channels of the rivers; hence the company last mentioned determined (in compliance with the suggestions of Mr. Weston, a British engineer, whom they had imported for their service), to extend *their* canal from river to river, a distance of 70 miles. In conjunction with the former company they nearly completed 15 miles of the most difficult parts of the two works; comprising much rock excavation, heavy embankments, extensive deep cuttings, and several locks which were constructed with bricks. In consequence of the commercial difficulties (in which it is known that some of the chief stockholders were shortly after involved, both companies were compelled to suspend their operations after the expenditure of $440,000. The suspension of these works, and *some* years after of the Chesapeake and Delaware canal, had a most disastrous effect on every similar work which was projected for many years afterwards. Frequent attempts were made from the year 1795 to resume operations; and there cannot be a doubt, if the state had *immediately*, on the first appearance of embarrassment, bestowed that liberal pecuniary assistance (which it eventually proffered when too late), that these canals would have been completed, and some of their patriotic and enterprising projectors rescued from ruin.

"Notwithstanding the subscription to the stock of the companies of $300,000, which was subsequently tendered by the state, these corporations continued to maintain a mere languishing existence.

"In the year 1811, these two bodies (which were chiefly composed of the same individuals), were reorganised and united by an act of assembly into one company—styled, 'the Union Canal Company.'

"*In this act they are specially authorised to extend their canal from Philadelphia to Lake Erie*, with the privilege of making such further extension, in any other part of the state, as they may deem expedient. As this work may be justly styled the great parent of all the canals which have since been executed in our country; inasmuch as it was projected, surveyed, described and held up for the imitation of other states, long ere the subject of canals had attracted attention in any other part of the Union (although the disasters which we have previously mentioned, retarded its *completion* until a very recent period); the interest which consequently attaches to its history, induces us at present to describe it more minutely.

"As large sums were required to resume operations with success on this canal, the legislature by an act passed March 29th, 1819, granted an interest of six per cent to the subscribers to the stock to be raised for this purpose: this interest was to be taken from the proceeds of the lottery before mentioned. By an additional act, March 26th, 1821, the state guarantied this interest.

"The additional subscriptions which were obtained in consequence of this legislative encouragement, enabled the managers to resume their operations this year, 1821. The line of the canal was re-located, the dimensions changed and the whole work finished in about six years from this period;

although thirty-seven years had elapsed from the commencement of the work, and sixty-five years from the date of the first survey.

"The Union Canal is nearly 80 miles in length from Middletown on the Susquehanna to a point on the Schuylkill a short distance below Reading. It is calculated for boats of 25 to 30 tons burthen.

"At Middletown, it is connected with the grand Pennsylvania canal leading to Pittsburg and Erie, to Tioga in the north, and to the Bald Eagle on the west branch of the Susquehanna. At Reading it is connected with the works of the Schuylkill navigation company leading to Philadelphia.

"The course of this canal is nearly parallel to the rivers Tulpehocken and Swatara, a route rendered necessary by the bold and abrupt declivities which invariably prevail on the margin of those streams."

"Pennsylvania may justly claim the credit of being the mother of the internal improvements of the Union. Seventy-seven years ago, two of her enlightened citizens first introduced canals to the public attention, by means of numerous publications; and seven years afterwards, by a survey of a route for the present Union Canal. This work was subsequently commenced in 1791, and four miles of it were navigable in 1794--5, when the work was suspended. One division of the line—the Schuylkill—was resumed by another company in 1816, and has been in operation since 1824. The period of its commencement and opening was prior to that of the New York canal, a work which many persons erroneously suppose to be the first in point of date, executed for the purpose of connecting the great rivers &c. of the interior with the sea board. The Schuylkill navigation is the greatest undertaking yet achieved in America by individual enterprise. The canals of Pennsylvania are more extensive than those of any state in the Union, being one-third of the aggregate amount existing in the United States. $37,000,000 have been expended by Pennsylvania, and by companies chartered by her, on works to facilitate inland navigation, rail-roads, turnpikes, and bridges—in addition to the enormous expenditures on roads and bridges by her counties. The sum above mentioned has been laid out since 1791, and the greater part of it since 1815. It may, perhaps, create a smile if the canal system, which has attained such an astonishing growth in the United States, be traced to its very embryo. The little insignificant canal, of about three-fourths of a mile in length, formed by cutting off the bends and deepening the channel of Dock Creek, in Philadelphia, a work which modern improvements have obliterated (with the exception of about 100 yards which still remain), was executed more than a century and a quarter ago, *and was, perhaps, the first canal executed in Pennsylvania, or in the Colonies!* The road leading from Philadelphia to Lancaster, made nearly forty years ago, was the first turnpike in the Union. Whilst the old bridges over the Schuylkill &c., near Philadelphia (which have given place to the noblest structures of the kind in America), were the first large structures erected for the passage of rivers in our country; at the present hour, Pennsylvania is unrivalled in the number, the magnitude, and the boldness of her bridges.

"Rail-roads were also first introduced in Pennsylvania. In 1816, the first rail-road on which self-acting inclined planes were erected, was executed by Mr. Boggs on the Kiskeminetas river; others (of small extent it must be confessed) were executed in several coal mines: at the present time 67 rail-roads, varying from 100 yards to 22½ miles, are in actual operation in this state alone; and including nine, which are in rapid progress, the aggregate number of miles which will be in operation before the termination of the present year will be 312. Several of these roads have double tracks, which do not form part of the preceding estimate. More than 35 years ago, Oliver Evans, of Philadelphia, discovered the hitherto unsuspected value of rail-roads, and published to the world that their merits had been unappreciated, their properties misunderstood, and their capacity for extended usefulness undeveloped. He earnestly maintained, that they ought not to be confined to limited districts, as the mere auxiliaries, or inferior substitutes to canals; that they were, in fact, greatly superior to the latter for the purposes of general commerce, and on the most extended lines. In these just, and now popular opinions, he stood alone—holding them not the less indubitable because they originated with him. No human being, either in Europe or elsewhere, had even dreamed that rail-roads were adapted to the transportation of passengers or merchandise, or that they could be usefully extended beyond a length of a few miles.

"The idea of employing steam as a means of propelling carriages, is well known to be almost coeval with the invention of the steam engine; but no mode of effecting this had ever been tried, or even suggested, unless the mere project of Watt, (which, with great deference be it mentioned, is now acknowledged to be utterly impracticable), which was never even attempted, be considered as an exception. Oliver Evans, who had never heard of steam being applied to this purpose, was early impressed with its importance, and commenced his celebrated experiments in 1784, and finished his first engine in 1801. Poverty compelled him to sell it to be used for another purpose. The other machinery of the carriage was in existence a few years ago. He immediately commenced another engine and carriage, and in the latter part of the winter of 1803—4 he propelled it by steam through the streets of Philadelphia, in the presence of more than 20,000 astonished and hitherto incredulous spectators. No rail-way then existed in America to test the capacity of this rude but primitive locomotive steam-engine: a temporary rail-way (the first ever attempted in America), was employed to prevent the wheels sinking into the ruts, or inequalities, on *part only* of the road traversed. This was the humble origin of that wonderful machine which is destined to revolutionize commercial intercourse by land. The plans and numerous drawings of Mr. Evans were sent to Europe, by his agent, and exhibited to many persons; his suggestions were copied without acknowledgement, and others have reaped the benefit of his discoveries.

"The superiority of rail-roads to canals, even when *horses* were employed on both, was zealously maintained by Evans before it had been imagined in Europe or this country, and their greater superiority, when locomotive engines should be adopted, was repeatedly pressed on the public attention. He endeavoured, without success, to urge the execution of a road from Philadelphia to Pittsburgh, and several years after, of a rail-road from this city to New York; in the latter he offered to take stock to the amount of $25,000; but he was in advance of the age in which he lived. His projects were regarded as visionary; although, at the present moment, both of these important roads are in rapid progress, and, in a few months, passengers will be whirled over these rail-ways, and gratefully remember their benefactor, Oliver Evans: a man whose projects have been in this instance accomplished, and whose predictions have been fulfilled to the very letter; although a strait jacket was voted to him formerly, almost by acclamation, as the reward of his genius. Fitch, who constructed the first steam-boat at Philadelphia in the year 1787, and Fulton, of Pennsylvania, who successfully introduced steam navigation, also obtained poverty and ingratitude as the reward of their exertions."

[When the preceeding volumes of the Encyclopœdia were composed, rail-roads were in their infancy; since that period they have acquired a new and important character. As they have attracted great attention in the United States, the following comparison and descriptions, extracted from the essay of G. W. Smith, also are inserted.]

"The attention of the writer was attracted to rail-roads when he was a boy. At a subsequent period he visited Europe in 1820 and 1821 and examined the internal improvements of Great Britain, particularly the rail-roads of that country), with great attention. Immediately after his return in 1821, he commenced his efforts for the purpose of introducing them into the United States. In advocating their superiority to canals, he for a long time stood alone and unsupported. In the year 1824 and subsequently, numerous essays and pamphlets were written by him on this subject, and distributed gratuitously throughout the Union.

"These preliminary remarks being made, a description of the rail-roads of the United States will next be given, including a list of all the rail-roads already made, which exceed five miles in length; and a description of several of the principal works in detail; this will enable the reader to understand the various modes of construction which are resorted to in the different parts of the Union, premising that rail-roads are, generally, preferable to canals, particularly in the United States, for the following reasons:

"1. They are practicable in every situation where the wants of the community may require them. Canals are frequently impracticable, either from a deficiency of water, or from physical obstacles which would render the expense enormous.

"2. The cost of constructing, maintaining, and repairing rail-roads is generally less than the cost of canals.

"3. Rail-roads are (almost without exception) less circuitous than canals.

"4. The transportation of goods and passengers can be effected with a much greater speed on rail-roads than on canals. Locomotive engines, on rail-ways, now travel at a rate which almost realizes the lover's dream--the annihilation of space and time. Riding on the wings of the wind is a dilatory process, compared to the more than hurricane speed which has been already attained on several rail-roads. The fleetest of the animal creation has been distanced by the iron limbs of a race horse, whose fiery spirit never flags, whose muscles never tire, who, in a single month, can travel over a space equal to the circumference of the great globe which we inhabit; a courser, who, moreover, can draw, when required, 1000 persons in his train, with a speed which even the philosophers of the age but yesterday pronounced as the dream of the visionary.

"The important consequences of rapid travelling, to those who are in pursuit of business or pleasure, may be mentioned—the facility of a frequent and expeditious intercourse among friends and relatives, merchants, manufacturers, and farmers—especially in cases of urgency--the conveyance of the mail, of troops and munitions of war, in case of invasion or insurrection, &c. Again, many articles will acquire a new value; provisions, which are incapable of long preservation—meat, poultry, fish, oysters, milk, butter, eggs, vegetables, &c., may be brought from an immense distance for consumption. Goods can be forwarded to suit the emergencies of commerce. The port which has access to the interior by a rail-road may take time by the forelock, and her merchants *may avail themselves of the constant fluctuations, the rapid changes in the markets, foreign and domestic.* They may hold intercourse with the immense regions of the interior at the most favourable moment, when the rivers and highways are in the best condition—when their snail-paced rivals, on canals, cannot even creep in sight of the districts where the harvest may have been already reaped. Again, their capital can be more frequently circulated from the frequency of their receipts and expenditures; consequently, a less amount of capital will be sufficient.

"5. Rail-roads are more easily kept in repair, and, when injured, the trade on the line is not necessarily and entirely stopped, although it may be sometimes impeded: their repairs can be speedily and cheaply effected within a certain period of time; consequently, the transportation on them will be regular, and without unforeseen and vexatious embarrassment and loss, and the consumer and producer will not at any time be deprived of a market.

"6. Rail-roads can be used during all seasons; they are not rendered useless by the frosts of winter or the droughts of summer, which materially detract from the utility of canals; whilst the constant liability of the latter to accidents, and the difficulty, tediousness, and uncertainty attending their repairs, diminish the limited period in which they might otherwise be employed. The greater exemption from injury (at least of that species which interrupts transportation), which characterizes rail-roads, has been already mentioned. The observation may be made, that no interruption, *even of a single day*, has occurred on any of the double track rail-roads since their first introduction into the United States. On the Mauch Chunk rail-road (which is a single line, hastily constructed, and the materials and plan not calculated for duration), interruption has occurred but five days, from its commencement in 1827 to the present time. Other roads have been more fortunate. Some of our canals are situated among the mountains, and in districts much elevated above the level of the ocean; consequently, they are frozen for a longer time than those near the tide water, which are open only 250 days in the year in the northern states; and even this brief period may be diminished by drought in summer, and by leaks, breaches, and other accidents. Great interruption is occasioned by the frequent freshets of our rivers, which, rising in their might, shake off the trammels which the puny efforts of man have attempted to prescribe for their governance: vast masses of ice, huge trees, and the wrecks of bridges, dams, and other structures, are borne away by a resistless force, and hurled with tremendous violence against the dams and banks of the canals which they encounter in their progress. Some of the dams of the Pennsylvania canal are injured, or prostrated, almost every year. During the last year the navigation of the whole western division was suspended for the summer and autumn by accidents; and the state canals, have from these causes, been navigable only for a few months in each year. During the present year, already have *three* great dams, which are essential to the supply of the leading canals of Pennsylvania, been swept with the besom of destruction. This havock will be of frequent occurrence, and the whole commerce of the interior will be suspended, sometimes for several months.

"The repairs of the damages on the Pennsylvania canals, which the recent freshets have occasioned, will require many months, and the expenditure of at least $450,000.

"The opponents of rail-roads have alleged that they are peculiarly liable to injury—that the rails might easily be broken or displaced by persons maliciously disposed. If this should be done, the wagons could be drawn for a short distance on the natural surface of the ground to the part of the railway which might remain uninjured. The injury could be speedily repaired, and the travelling would be either uninterrupted or slightly impeded. No injury would be sustained by the embankments; for it would require as much labour and time to destroy them as was expended in their construction. Every work of man may be injured by violence. Our dwellings, our bridges, our ships, may become the prey of the incendiary; all our property is at the mercy of the desperate and malignant. But does this contingent evil ever induce mankind to forego the certain benefit which results from the use of such property? Such contingent evil is not, however, peculiar to rail-roads—canals are much more liable to injury—to injury easily inflicted—susceptible of concealment, and most disastrous in its effects—requiring much time and expenditure to repair. An embankment may be perforated by a stick in a few seconds; the water, at first oozing out almost imperceptibly, would soon enlarge the aperture; and the rushing and uncontrollable torrent would sweep away the most stupendous embankments, and strew their ruins over the desolated fields below them. *Many miles* of the canal would thus be rendered unnavigable. The injury inflicted on a rail-road is confined to the spot where the outrage is perpetrated. Canals have been injured in the manner just mentioned, in the United States; and the writer has seen the damage which, on one or two occasions, has been sustained.

"The use of canals is, from all these various causes, not only limited, but also very uncertain: fleets of boats are frequently detained without a moment's warning; sometimes for weeks, and even months; sometimes, also, they are suddenly frozen up. The present year has afforded a striking illustration of the defects of canals. The transition from autumn to a most severe winter was effected in a few hours; hundreds of boats were suddenly frozen up, and thousands and tens of thousands of tons of coal, produce and merchandise could not be taken to their places of destination. The cities of Philadelphia and New York were destitute of their supply of fuel; the most serious inconvenience, and even intense suffering among the poor, was the result: several persons perished in consequence of the cold; whilst a raging epidemic spread misery and death in an unusual proportion among the destitute. The price of fuel rose 100, and even 200, per cent. The whole commerce of the country was paralyzed. If rail-roads had been adopted in lieu of the existing canals, transportation could have been effected without any interruption. The city of Baltimore was abundantly supplied, every day, by means of her rail-roads: fuel was sold at the usual price. The saving in this single article has been sufficient to render the value of these roads more generally appreciated. During the previous winter a deep snow covered the country—the canals, as usual, were sealed with ice, and even the great highways of the country were for some days impassable. The snow drifts were heaped up in the excavations of the rail-roads to a height of many feet—but the application of the snow-plough removed every impediment from the rails, and the intercourse continued without interruption.

"The great rivers of our country, by means of which most of the interior commerce of our citizens is conveyed, usually rise, and are in a good condition for navigation very early in the spring, or in the early and latter part of the winter: they rise and fall rapidly at all seasons: the canals which connect them are often necessarily of great length, and are trammelled by numerous locks. The cargo of a boat, if sent from Philadelphia to Pittsburgh by the Pennsylvania canal (even if the latter were navigable as early in the season as the great rivers of the west—a circumstance scarcely ever to be expected), could not reach its place of destination in less than a fortnight, even if it proceeded day and night—and the time would probably be longer. In the mean time the rivers might subside, and their navigation be impeded. The Susquehanna, at Middletown, is swarming with vessels which descend that river during the freshets, and are detained for days at the locks of the Union canal before they can enter it in their regular turn. Again, at the opening of many canals, in the spring, the sudden deluge of trade creates a glut in the market—a depreciation in the price of produce, which is extremely injurious to the proprietors; at other seasons there is a scarcity, equally injurious to the merchant and to the consumer. Both results are prejudicial; they derange all calculations, interfere with the regular course of industry, and render trade a lottery. Regularity, not less than certainty, constitutes the soul of commerce. In these desirable and all-important properties, rail-roads are immeasurably superior to canals.

"7. Rail-roads do not injure the health of the districts through which they pass: canals occasion wide-spread disease and mortality: the damp atmosphere, hovering over them and their vicinity, is eminently prejudicial to health; the deadly miasma which is also generated by them, affects the whole neighbourhood; rheumatism, colds, remittent and intermittent fevers, are the almost invariable concomitants of their almost stagnant waters, and the lands which receive the water from their numerous leaks. In our southern climate, canals are pestilential, and disease and death are their never-failing drawbacks.

"8. Rail-roads do not injure land by leakage, nor do they divert water-courses from their accustomed channels, and thereby interfere with mills, meadows, and land.

"9. Rail-roads do not present inconvenient and impassable barriers, whereby farms and streets are separated.

"10. The tolls on rail-roads may be less than on canals.

"11. The cost of transportation will be usually less on rail-roads than on canals, if the preceding circumstances be considered.

"12. Rail-roads are susceptible of great improvements; a great augmentation of their value has already been produced by recent meliorations: new modifications and applications are almost daily discovered, and others may be anticipated, increasing their utility, diminishing their expense, rendering them more durable, safe, and convenient. Canals, on the contrary, have been almost stationary for nearly two centuries, and, from their nature, seem to be incapable of any material improvement.

"Rail-roads are, therefore, more convenient and better adapted to the wants and means of our country than canals; although, in some *few* cases (which may be considered as exceptions to the general rule), the latter *may* sometimes be more eligible—particularly when the face of the country is nearly level, and when the supply of water is abundant—the climate mild and healthy—when speed is unnecessary in the conveyance of goods or passengers —when interruption of the trade, during the frost of winter or the drought of summer, is productive of little injury—when canals, or slack-water navigation, can be effected at a cheaper rate, or, finally, when by means of a short canal, connecting an extensive line of existing navigation, a transhipment can be prevented. Every case must depend on its peculiar circumstances; and the conclusion will not, therefore, be invariable. The remark may, however, be made, that there is not a canal exceeding five miles in length, in Pennsylvania, New York, New England, or Ohio (and some other states might be mentioned), which is not a clear misapplication of capital; in every instance rail-roads would be far preferable. The canal system is superannuated and incapable of improvement: it is unable to withstand the assaults of its youthful, vigorous, and popular adversary—whose movements outstrip the speed of the wind—a giant who is daily increasing in strength, improving in skill, abounding in resources, and exhibiting a capacity in accordance with the spirit of the age. This adversary, engendered by the necessities and nurtured by the civilization of the nineteenth century, is about to terminate the supremacy of its once favoured rival —a rival to which but yesterday it was a feeble auxiliary—an humble dependent. Commencing its career at our Atlantic cities, it may be traced by its tracks, in its progress, to the boundless regions of the far west—striding over valleys and rivers—scaling the loftiest mountains, or clinging to the sides of rugged precipices—resting in safety on the bosom of the most treacherous and bottomless marshes, or hewing its way through rocks and every opposing obstacle, with a triumph which might almost rouse the astonished spirit of Brindley from the grave—wending its way into every spot where its presence is desirable, and extending its arms to embrace the commerce of a nation—it diffuses the productions of distant climes with a profusion previously unknown, and with a celerity almost realizing the dreams of the visionary. America, where the value of rail-roads was first discovered, is destined to be the theatre of their greatest extension and triumph—although the discoverer, to whose genius the world is indebted for the treasure, was scoffed at, while living, as an enthusiast and sunk into the grave poor and broken-hearted, the nineteenth century may yet render to the memory of the inventor of the locomotive engine—Oliver Evans, of Pennsylvania—the tardy homage of their gratitude: to the man whose far-sighted sagacity foresaw and predicted, and whose mechanical intellect effected the triumph of the rail-road system."

Pennsylvania Rail-road.

"The legislature of Pennsylvania authorized the Union Canal Company (in their charter granted in 1811), to construct rail-ways as appendages to that work.. These, however, were intended as mere auxiliaries to the canal, and were not executed. On the 31st of March 1823, a law was passed, authorizing John Stevens and others to make a rail-road from Philadelphia to the Susquehanna; the remainder of the road to Pittsburgh, which was asked for by the petitioners was not authorized. Surveys were promptly executed by the parties, but they were based on defective principles. The delay in obtaining subscriptions for this unprecedented enterprise (*the first of the kind which was ever projected in any part of the world, and the first which was ever authorised by law in the United States*), induced the friends of this work to apply to the legislature for certain alterations in the act of assembly; accordingly, an act was passed on the 7th of April 1826, annulling the act of 1823, and authorising the formation of a new company. Surveys were, in the mean time, in progress under the authority of the general and state governments, embracing the country through which the projected *canal* of the state was expected to pass. Until the completion of these surveys, no aid to the rail-road could *at that time* be obtained from the state. In the following year, however, on the 9th of April 1827, the legislature yielded to the wishes of the majority of the friends of the rail-way, who were anxious that the *state* should execute the road, and a new survey was authorised. In order to gratify the wishes of a few persons, who still imagined that a canal was practicable on this route, the engineer was ordered to report the facts in relation to a canal also. The result was reported to the legislature; and they authorized, on the 24th of March 1828, the *construction* of this rail-way as a state work. *This rail-road is, therefore, the first which was undertaken in any part of the world by a government.* Prior to the passage of this latter act, namely, on the 5th of April 1826, they had authorised a company to construct a rail-road, as “a public highway for the transportation of persons and commodities,” from the Lackawaxen to the Lackawanna; and a company incorporated on the 11th of March 1826, was authorised by a supplementary act, passed the 16th of April 1827, to construct a rail-road from the Great Bend of the Susquehanna to the mouth of the Lackawanna, forming a continuation of the former road. The first part of this work has been in *operation* for three years. An act was also passed, on the 5th of April 1826, authorizing a company to construct a public rail-road from Pottsville, on the Schuylkill, to the Susquehanna. This work is not finished, but is in rapid progress. These acts are prior to any passed in other states.

“ The Pennsylvania rail-road is not a continuous line, as might be supposed from the title, but is composed of two divisions, separated by a canal of 171 miles in length. The first division is commonly styled the Philadelphia and Columbia rail-road, and the second the Alleghany Portage: each will be described in order.

“ The first division (the history of which has just been narrated) commences in the city of Philadelphia, at the corner of Broad and Vine streets, whence various branches, *constructed by the several corporations*, will diverge. The main line proceeds northward to Callowhill street, and thence is curved to the west, and is continued due west along an avenue, which is designed to be 100 feet broad. The road is straight for about three quarters of a mile, and conforms to the inclination of the streets which are within the limits of the grades prescribed for the residue of the line. The road is then curved to the north-west, and proceeds afterwards in a straight line to the entrance of Pratt's gardens, where the cut of 70 feet deep, and one-fifth of a mile long, commences. This cut was executed in 1792, for the bed of a canal which has been long abandoned. The line then continues nearly parallel to the river Schuylkill, and generally occupies the bed of the old canal (which has been altered for the purpose), to the bridge over this river below Peters's Island. This viaduct is 984 feet in length between the extremities of the wooden platform, which is elevated 37 feet above the water. The stone piers are six in number, and the greatest depth of the foundation, below the surface, is 24 feet. These piers rest on rock, or compact gravel; coffer dams have been resorted to here. Crossing the stream, by this noble viaduct, the line is conducted to the foot of an inclined plane, which is located on the bank. This plane is straight, and uniform in inclination; the length of it is 41 chains 60 links, the height 187 feet. The line is continued on the dividing ridge, between the waters flowing into the Delaware and the Schuylkill, and attains the first principal summit (547 feet above mean high tide), at a point near the Warren tavern; it then gradually descends the South Valley Hill into the Great Valley of Chester county, and crosses Valley Creek by a viaduct 577 feet long, the piers of which rise 58 feet above the water. Here the road approaches the southern slope of the valley, thence it is continued, and crosses the eastern branch of the Brandywine river by a viaduct situated immediately to the south of Downingtown, then it crosses the western branch of the river, just mentioned, by a viaduct at Coatesville. The viaduct over the Big Brandywine is 465 feet long, the the piers rise 26 feet above the water. The viaduct over the Little Brandywine is 850 feet long, the piers rise 73 feet above the water. The piers of this structure are composed of rubble masonry, and are supposed to be the loftiest of the *kind* in existence. Thence it is located on the northern slope of the valley, which it now leaves, and ascends along the margin of a branch of the Octarara Creek (a tributary of the Susquehanna), to the second principal summit at Mine Hill. It passes through the Great Gap, in this ridge, by a cut of 37 feet deep. This summit is 555 feet above mean high tide at Philadelphia. Thence, gradually descending, the road proceeds westwardly, crossing the Pequa by a viaduct 145 feet long, elevated 18 feet above the stream, and Mill Creek, by a viaduct 550 feet long and 40 high, and the Big Conestoga by a viaduct 1412 feet long, elevated 60 feet. The plan is what is *commonly called* Town's; and this is the only instance on the line where it has been adopted. Seven of the eight large viaducts on this rail-road are made according to Burr's plan. The road then enters the city of Lancaster on the northern side; thence it is conducted across the Little Conestoga, by a viaduct 804 feet long and 47 high, in a direction towards the head of the inclined plane at Columbia. This plane is straight, the length 1720 feet, the height 90 feet. From the foot of the plane the road is conducted through Columbia, along the margin of the Susquehanna, to the outlet lock in the basin which terminates the great Pennsylvania canal. In the heights above mentioned, it is intended to describe the height of the piers above the surface of the water. The lengths include only the platforms, independent of the wing walls. On the line there are 31 viaducts. The aggregate length of the platforms of the *viaducts* is 7,349 feet. There are also 73 stone culverts, &c., having from 3 to 25 feet span (the aggregate of the spans being 538 feet), and nearly 500 stone drains, generally 2 feet wide, and 3 in the clear. There are 18 common road and farm bridges, 8 of which have stone arches of 25 feet span; the remainder have stone abutments, &c., and wooden superstructures; the span varying from 31 to 54 feet. The length of the rail-road from Vine street, in Philadelphia, to the the termination is $81\frac{6}{10}$ miles, and the whole is in rapid progress. The road formation of 80 miles is finished, and the remaining $1\frac{6}{10}$ miles will be finished in a few weeks; with the exception of two viaducts, and the deep cut through Mine Hill (which will not be finished until September). A temporary ferry will form a substitute at the Schuylkill until 1833, when the viaduct will be used. Westward from Philadelphia the rails are laid on a number of sections, and wagons are employed on them. Travelling has commenced; and the rails for the first track may be laid on the residue of the road during the present year. The cost will be about $28,000 per mile, viz. $12,000 for graduation and bridges, and $16,000 for the rail-way or superstructure."

Six plans of rail-way have been adopted on various parts of the road, viz:

1. The use of granite sills, or rails, is confined to the first 10 miles westward from Philadelphia; these are from 4 to 9 feet long, and at least 1 foot wide, and 1 thick; and the trenches are 22 inches deep, including the thickness of the road metal, and are filled with small broken stone. These sills are arranged in continuous parallel lines. On the upper surfaces, near the inner edges, flat iron bars, 15 feet long, $2\frac{1}{4}$ inches wide, and five-eighths of an inch thick, are attached by square nails, $3\frac{1}{2}$ inches long, and $\frac{1}{5}$ inch in diameter, driven into cedar plugs five-eighths of an inch in diameter, which are inserted in holes $3\frac{1}{2}$ inches deep, drilled into the sills at intervals of 18 inches asunder.

"This part of the rail-way has recently been carefully examined by the engineer. The severe winter of 1831—2 (during which the frost was intense, and several thaws occurred) *has not in the slightest degree affected the stability of the rails.*

"2. Seventy chains on the recently formed embankments of the city division (commencing at the short curve of 300 feet radius, in the streets of Philadelphia, at Broad and Callowhill streets), are composed of Carolina string-pieces, six inches square; the iron bars $2\frac{1}{4} \times \frac{5}{8}$ of an inch; the sleepers, of the usual form and size, rest on bearing timbers eight inches square, secured by ties 20 feet apart. The edge rails, of rolled iron, are 16 feet long, $3\frac{1}{2}$ inches deep, and are parallel at the top and bottom: they weigh $41\frac{1}{4}$ lbs. per yard. The cost in England was 6*l.* 17*s.* 6*d.* per ton: cost, delivered in Philadelphia, $\$50\frac{50}{100}$. The cast-iron chairs weigh 15 lbs. each; the nails, or bolts, 10 oz. each; the two wrought-iron wedges to each chair, weigh each 10 oz. On the turn-outs the rails weigh 33 lbs. to the yard; chairs 12 lbs. each.

"3. The stone blocks are $3\frac{3}{4}$ feet apart on the straight lines, and three feet on the curves. Seventeen miles of single track have stone blocks; nine miles have stone sills.

"4. The residue of the single track, and probably all but the city division of the second track, will rest on wooden sleepers, placed in trenches across the road, filled with broken stone. The rails and chairs will be similar to those resting on the stone blocks; the latter are 20 inches by 12, and upwards, and are placed in trenches in the same manner as the stone sills.

"5. On the new heavy embankments, bearing timbers are placed beneath the sleepers.

"6. In crossing a ravine, near the Conestoga, the road is supported by *truss work* for several hundred feet in lieu of an embankment.

"The line traverses a very undulating country, and crosses the streams at right angles; consequently the expense of the road formation has been unusually great; the excavations are frequently deep, and the embankments extensive and lofty. Near the Warren tavern, the surface of the road is elevated 80 feet above the bottom of a ravine. The cut at Mine Ridge is 37 feet deep, through gravel abounding in springs and difficult quicksands. Large, but judicious expenditures have been incurred, to render the line as straight, direct, and level, as the country would permit. The curves have greater radii than those which have been resorted to on any *extensive* rail-road, located across ridges, in Europe or America. The length of the line is only a few miles greater than that of the turnpike between the same points. The length from *Fairmount*, to the basin at Columbia, is $80\frac{1}{4}$ miles by this rail-road. By the Schuylkill, Union, and Pennsylvania *canals*, which connect these points, the distance is 158 miles, *or twice the length of the rail-road.** The *maximum* grade never exceeds $30\frac{6}{10}$ feet to the mile, and this only in the direction of the greatest trade. Two points, only, require stationary engines. The width of the road bed is, in general, 25 feet, and sometimes it is wider. If the profile be analyzed, it will be perceived that 71 per cent of the useful effect of a perfectly level line, will be attainable of a line perfectly level. It is almost unnecessary to add, that every division of this great work evinces the skill and sound judgment of the engineer, Major John Wilson, to whom it has been entrusted from the commencement.

"*Branches.*—At the termination of the state rail-rail-road, at the corner of Broad and Vine streets, a continuation of the line, along Broad street, southwardly, through the city, and thence to the Delaware, a distance of about $2\frac{1}{2}$ miles, is to be commenced, without delay, by the corporations:

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* A law has been passed authorizing the construction of the rail-road through the middle of Lancaster. This pernicious project will injure the line, increase the length, and delay, and expense of construction, repairs and transportation, and be a perpetual tax on the trade.

and a junction is to be formed with the Delaware, north of the city, by a line about $1\frac{1}{3}$ mile long. Also a branch, four miles in length, which forms a junction with the rail-road from Philadelphia to Norristown. A company has been formed to construct a branch from Downington, *via* the valley of the Brandywine, to Wilmington; the surveys have been published, but the work is not yet commenced. Another company has been authorized to construct a branch towards Port Deposit, on the Susquehanna, *via* Oxford. The surveys were made by a corps detailed by Major Wilson. It is contemplated to extend this branch to Baltimore, for which purpose a company has been formed in the state of Maryland. A branch of nine miles in length from the South Valley Hill to West Chester has been made, and will be opened during the ensuing month."

Allegheny Portage Rail-road.

This is the most important work in the United States, inasmuch as it forms at present the only rail-road communication between the Atlantic states and the great valleys of the Ohio, Mississippi, Missouri and their tributaries. It is now acknowledged that no canal is practicable across the Allegheny mountain in any part of its course; rail-roads have, therefore, been *projected* to cross it at several points —none of which have been commenced, except the one which is now described.

"It commences at Johnstown, on the Conemaugh river, and rising $1171\frac{58}{100}$ feet, by means of five inclined planes and gently graded stages, attains the summit of the mountain; it then descends in the same manner, by five inclined planes and graded stages, $1398\frac{71}{100}$ feet. One of these stages descends at the rate of 52 feet per mile. All the inclined planes are straight, and the greatest angle of inclination with the horizon is $5° 51' 9''$. The curves on the residue of the road have larger radii than the rugged surface of the country would at first seem to admit. On the western slope of the mountain the rail-road passes through a tunnel 900 feet long, 22 feet wide and 19 high, excavated through rock. The bridges are of stone, one of which, over the Conemaugh, has a span of 80 feet; two of these are *skewed.* Stationary steam engines are located at the head of each inclined plane. The length of the road is $36\frac{69}{100}$ miles. The grading is nearly finished, and the first track will be laid before the termination of the present year. The edge rails are of rolled iron of the Clarence pattern, weighing 40 lbs. to the yard. The chairs weigh 12 lbs. each; they rest on large stone blocks placed three feet apart from centre to centre. On the heavy embankments wooden sleepers and bearing timbers support string pieces and iron bars, similar to the eastern division of the Pennsylvania rail-road. A space, 120 feet in width, is appropriated to the road, of which 25 feet in width is now graded. The second track will be laid in the course of the ensuing year.

Mauch Chunk Rail Road.

"This work commences at the coal mines which are, in fact, in the valley of the Little Schuylkill, on the Panther Creek, a short distance below the summit of Mauch Chunk, or "Mountain of Bears." It is used for the purpose of carrying the Schuylkill coal from this valley to the top of the mountain, and thence to the Lehigh river: hence the common, but erroneous name of this coal, in the market, is Lehigh coal. The road was commenced in the winter of 1826—7, and finished in four months. The extent of the main line, which is single, is nine miles, and the branches and side lines extend in the aggregate $3\frac{3}{4}$ miles. This was the first rail road of any considerable extent in the United States. The Quincy road, near Boston, was commenced in 1826, but its extent was only three miles; and a number of rail-ways of less length had been in use for a number of years in *Pennsylvania.* Rail-roads, however, were then in their infancy in this country. This work was executed without the superintendence of a rail-road engineer. Notwithstanding the mechanical ingenuity of the public-spirited, enterprising, and estimable gentleman who directed the execution of this primitive rail-way, imperfections might be, of course, expected to exist in the structure and location. The latter is peculiarly disadvantageous. Although this road has been referred to by the uninformed, as a specimen of the capacity of rail-roads, it is well known to those who are conversant with the subject, as the least efficacious of all the extensive rail-roads in America. The useful effect produced by a horse is far *less on it than on any rail-road in the Union.* The plan exhibits continual, frequent, and often very abrupt curves; some of the radii are only 190 feet. A few of them have subsequently been slightly improved. These curves were, moreover, irregular; formed with no precision or mathematical science. The profile is very irregular. The mine in which the rail-road commences is 860 feet above the Lehigh at Mauch Chunk. From the mine to the summit, 960 feet above the Lehigh, the line *ascends* 100 feet in three-quarters of a mile, $= 133\frac{1}{3}$ feet in a mile; and this steep stage is worked solely by horse power. One-third of a mile, at the summit, is nearly level; thence, for eight miles, the line descends 745 feet to the *head* of the inclined plane (the latter is 750 feet long, and 215 feet high), the grade being from 0 to 107 feet per mile, and in one place, for 80 yards, it is 1 in 25.

Baltimore and Ohio Rail-road.

"In the year 1827, the citizens of Baltimore having ascertained that a canal was impracticable from that city to the Potomac, and that the execution of the Chesapeake and Ohio canal would be attended by enormous expense, unprecedented difficulties, and great delay and embarrassment—and being also convinced that rail-roads possessed numerous advantages over canals—they determined, on the 19th of February 1827, to construct a rail-road—a decision evincing their foresight, wisdom, and enterprise. Rail-roads had several years previously begun to attract attention in Pennsylvania, and a number of charters had been already granted in this state, and one in New York, authorizing rail-roads—several of which have been finished. A charter was immediately obtained, on the 28th of Feb ruary 1827, and the work was commenced on the 4th of July 1828, by laying the corner stone of a monument near the rail-way, and a few months afterwards the road was actually begun, and has been prosecuted with great vigour.

"It commences at the city block, in Baltimore, and passing thence to the depot, near the head of Pratt street, $1\frac{1}{2}$ mile, it is continued to the verge of the city plot, and thence to the Point of Rocks, on the Potomac river, a total distance from the City Block of $69\frac{1}{8}$ miles. At this point the progress of the work has been temporarily arrested, in consequence of the canal company having obtained a prior right of way. The length of the rail-road, from the Point of Rocks to Pittsburgh, on the Ohio, will be about 260 miles at least: a reconnoissance of this part of the line has been made, but only a small portion of it has been surveyed. The road may, however, according to the charter, be conducted to some other point on the Ohio, between Pittsburgh, and the mouth of the Little Kenhaway.

"The most difficult and expensive portion of this great rail-road is nearly finished, and in point of length it is surpassed by only three or four rail-roads in any part of the world. The eastern portion of the Pennsylvania rail-road (which will not be in operation throughout until December next) is only 15 miles longer.

"In addition to the main line, extending $69\frac{1}{8}$ miles, a branch of three miles 130 poles, graded for a double, but laid with a single track, has been made to the city of Frederick.

"The road bed is 26 feet wide. The grade for the first 29 miles from Baltimore does not exceed in any place an ascent of 22 feet per mile; on the next 11 miles, from 22 to 30 feet; on the next 3 or 4 miles, from 30 to $47\frac{1}{2}$ feet. At the distance of $40\frac{3}{8}$ miles from Baltimore, commences the first inclined plane, which ascends $80\frac{375}{1000}$ feet in a length of 2,150 feet. The second inclined plane ascends $99\frac{605}{2000}$ feet; the length is 3000 feet. The summit, (elevated $813\frac{250}{1000}$ feet above mid tide), thus attained, is $42\frac{544}{1000}$ miles from Baltimore. The line then descends by two inclined planes, Nos. 3 and 4. No. 3 is 3,200 feet long, and descends $159\frac{630}{1000}$ feet. No. 4 is 1,900 feet long, and descends $81\frac{350}{1000}$ feet. All the planes are straight. On the next five miles, the grade does not exceed 37 feet, except at two places, extending 1,176 feet, where it is 52 feet to the mile; the residue of the line to the Point of Rocks is much less steep.

"The plan of the road presents numerous, and frequently abrupt curves. Of the $67\frac{5}{8}$ miles, extending from Baltimore, at the depot, to the Potomac, 33 miles and 615 feet, in the aggregate, are straight; 13 miles and 3,963 feet are composed of curves, the radii of which vary from 955 feet to infinity, and about 21 miles have radii varying from 395 to 955 feet; one curve, 1,400 feet long, has a radius of only 318 feet: another, 1,100 feet long, has a radius of 337 feet. On the branch, 2 miles and 1,034 feet are composed of straight lines—the minimum radius of curvature is 477 feet. The maximum grade per mile is $30\frac{096}{1000}$ feet.

"The viaducts are, with two exceptions, constructed entirely of masonry; these have materially increased the cost of the road, particularly on the first 13 miles, where they were adopted in preference to wooden superstructures, contrary to the opinions of the engineers. These viaducts are massive, imposing, magnificent, expensive, and injudicious structures. Dressed stone has been used in a few cases, thereby increasing the expense. The number of viaducts is 33, of which 31 are built entirely of stone; one of 12 feet span has stone abutments and a wooden superstructure; another, across the Monockessy, has three arches of 110 feet span each; the piers and abutments are of stone, the superstructure of wood, without a roof.

"The Carrolton viaduct, near Baltimore, has an arch of $80\frac{1}{4}$ feet span, and a small arch of 20 feet span.

"The Patterson viaduct, across the Patapsco, has two arches of 55 feet span, and two small arches (for roads) of 20 feet each. The Oliver viaduct has three arches of 20 feet span each. The residue of the viaducts have single spans: namely, three viaducts have spans of 10 feet; 10 have 12 feet; three have 14 feet; one has 15 feet; seven have 20 feet; three have 25 feet; one has 30 feet; and one has an arch of 40 feet span.

"The masonry on the 71 miles 916 poles (including the branch) consisting of 80,303 perches has cost \$318,072 and $41\frac{1}{4}$ cents; of which $58,244\frac{1}{2}$ perches of arched masonry cost \$274,201 and 76 cents, and $22,058\frac{1}{2}$ perches of culverts, detached walls, &c., cost \$43,870 and $65\frac{1}{4}$ cents. The additional cost of graduation, exclusive of masonry, is estimated in the last annual report at \$783,542 and 84 cents; making the total sum, for *graduation and masonry*, of \$1,101,615 and $25\frac{1}{4}$ cents, of which \$30,258 and $91\frac{1}{4}$ cents is assigned as the cost of the branch. The first 13 miles constitute by far the most difficult and expensive portion of the line. The graduation of this part has cost \$29,200, and the masonry \$17,154 and 56 cents per mile; being \$46,354 and 56 cents for these items alone. The cost of graduation of these 13 miles being \$8,994 and 16 cents more than the cost of the remaining $54\frac{5}{8}$ miles; whilst the cost of the masonry on the first $8\frac{3}{4}$ miles only, is equal to the cost of the masonry on the remaining $58\frac{7}{8}$ miles; or the aggregate cost has been nearly in the proportion of $5\frac{1}{2}$ to 1. The first 13 miles present a continued series of stupendous embankments and excavations—an unusual proportion of the latter through rocks.

"The cut near Baltimore is 70 feet deep; 310,250 cubic yards of earth were removed from it, at an expense of \$122,118 and $33\frac{1}{4}$ cents. Gunpowder was used for the purpose of loosening the tenacious earth of this great excavation.

"The great embankment across Gadsby's Run has a maximum elevation above the surface of 57 feet: it contains 210,101 cubic yards, and cost \$65,584 and $35\frac{1}{2}$ cents.

"The cost of graduation and masonry on the residue of the line is stated at only \$8,532 and 16 cents per mile; and the *total cost* of the rail-road, on this extensive portion, at 20,168 per mile—a sum which the company state to be ample for the work in its farther progress to the west. The *average* cost for graduation, masonry, bridges, and rail-way, (composed of double tracks) has been on the whole line $27,128 per mile; but $30,000 will probably be required to defray all the expenses.

" The *rail-way* is not uniform, stone sills, stone blocks, and wooden sleepers being used on different parts of the line. Forty miles of single track (equivalent to twenty of double track) are composed of granite sills, eight inches thick, 15 wide, and of various lengths: these are laid in trenches, filled with broken stone. This species of rail-way is used, at intervals, on the eastern slope of the road. The cost of it when completed, including iron, &c. will be about $12,500 per mile for the double track. The iron rail is attached too near to the inner edge of the stone, the bearing is not uniform, and the stability of the rail-way is impaired. On part of the Pennsylvania rail-road, where stone sills are used, this defect also exists; but it has been lessened by placing the iron rail nearer to the centre of the stone sill.

" Six miles of single track are composed of stone blocks and wooden string-pieces, &c. similar to the Mauch Chunk and Cold Run rail-road, in Pennsylvania; the blocks on the former contain from one to two cubic feet, and are not one-third the size of those used on the latter, and they are laid in small detached pits, filled with broken stone, in lieu of trenches. The latter plan facilitates drainage. The pits, when unconnected with side drains, form receptacles for water in some soils. The blocks are four feet apart, from centre to centre. The whole of the residue of the line rests on wooden sleepers, which are not less than five inches thick at the smaller end, and frequently they are larger: they are also four feet apart, and are placed on broken stone, contained in pits, in the same manner as the blocks. The earth between the pits is not protected by broken stone: the action of the frost on it must, therefore, impair the stability of the sleepers. The wooden rails are secured by wedges, in the usual manner. The notches are, of course, wider at one end, but they are cut *vertically*. On the Little Schuylkill rail-way the notches are wider below than above; the wedges are less subject to displacement on the latter. The sleepers on the Baltimore and Ohio road are hewn out in the centre, to make room for the horse-path, and the greater portion of the wood work is covered by broken stone, earth, &c. The rail-way is thus rendered firmer, but the materials are more subject to decay.

" The string-pieces are, throughout the line, six inches square, and the iron bars are 15 feet long, (pierced by 11 oblong holes) 2¼ inches wide, five-eighths of an inch thick, and are cut off obliquely at the extremities.

" The wheels of the wagons are made in accordance with the old fashioned plan formerly pursued on some of the colliery rail-roads in Great Britain —the felloe being slightly conical, and curving towards the flange: this has, however, been claimed as a new and important invention. The novelty of rail-roads, in this country, has induced many ingenious persons, connected with this rail-road, to submit to the public, through the press, a number of devices purporting to be original; all of which (so far as they have been examined by the writer) are either in use, or have been proposed elsewhere, with two exceptions; namely, the mode of oiling the friction wheel of the wagon, claimed by Winans, and the plan of oiling common axles by means of a cork floating in oil; the latter was introduced by Colonel Long. Notwithstanding the frequent introduction of " modern antiques," to public notice, through the medium of the Baltimore papers, the press of that city has rendered services of the greatest value and importance to the community, in sustaining the cause of rail-roads by much sound argument, and the promulgation of numerous facts.

" The rail-road which has been described, is destined to confer as much prosperity on the city of Baltimore, as the enterprise of the company has already conferred reputation on her public-spirited citizens.

" In addition to the works already mentioned, many rail-roads are in rapid progress. The first number in the list below indicates the extent proposed, the second, the number of miles finished, or that will be finished in the course of this year.

" In *Pennsylvania.*—1. Philadelphia, Germantown, and Norristown rail-road, 18¾ (6 f.).

" 2. Little Schuylkill, 27½ (22½ f.).

" 3. Danville and Pottsville, 47½ (11 f.).

" 4. Mine Hill and Schuylkill Haven, 15½ f.

" 5. Mount Carbon, 8 f.

" 6. Schuylkill Valley, 10¼ f.

" 7. Room Run, 5⅓ f.

" 8. Lykin's Valley, 16½ f.

" 9. Carbondale and Honesdale, 16⅓ f.

" These roads have numerous small branches, which latter are not included.

New Jersey.—10. Camden and Amboy, 61 (34½ f.).

" 11. Patterson and Hudson, 16 (16 f.).

" *Delaware.*—12. Newcastle and Frenchtown (16½ f.).

" 13. Baltimore and Susquehannah, 70 (21¼ f.).

" *Virginia, &c.*—14. Chesterfield (13 f.).

" 15. Petersburg and Roanoke, 60 (30 f.).

"*South Carolina.*—16. Charleston and Hamburg, 135 (135 f.).

" *New York.*—17. Harlæm, 8 (8 f.).

" 18. Hudson and Mohawk (15¾ f.).

" 19. Schenectady and Saratoga (22 f.).

" 20. Ithaca and Owego, 29½ (29½ f.).

" *Massachusetts.*—21. Boston and Lowell (— f.).

" *Kentucky.*—22. Lexington and Louisville, 96 (15 f.).

" Many rail-roads will be commenced during this and the ensuing year. Charters have been granted for rail-roads extending in the aggregate 5460 miles, of which 1350 will be finished by 1833; many of the works thus authorised will not be commenced; every day adds to the number and magnitude of these popular projects.

CLIMATE OF THE UNITED STATES.

When North America began to be colonized by the northern nations of Europe, it was soon discovered that, in winter particularly, the temperature of the atmosphere in any given latitude was much more rigorous, than in like latitudes of Europe. Such difference excited a very natural astonishment, and as the real cause was unknown, many very fanciful, and some very absurd theories were formed to account for the phenomena. Some of these theories may be seen under the head of Climate in the Art. America, Vol. I. page 582, and supra.

Without pretending to decide a problem, demanding such extensive element for its complete solution, we proceed to state observed facts, and with very few comments leave the question to further discovery. Before, however, we proceed to arrange our data, we beg leave to observe that the climate of America, cannot be understood without being taken as a part of the atmospheric constitution of the whole earth; we therefore present the subject under two heads; Prevailing Winds, and Thermometrical Observation.

Prevalent Winds.—Assuming the motion of the atmosphere, as arising from one general cause, and that motion as the true cause of climate, we place it before the results of observations made by the aid of the thermometer, which latter we trust to show are mere effects produced by the winds.

TABLE XIX.

Prevailing Winds, at various Points on the continent of North America, above N. Lat. 35. *The whole numbers reduced to proportions of* 1000.

Places of Observation.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.	Observer.
Polar Sea,	394	79¾	132	32	112	28	122	100	Parry.
Fort Brady,	59	274	79	86	241	73	32	58	Dr. Lovell.
Basin of Columbia,	118	44	401	33	200	53	130	20	Lewis and Clark.
Valley of Missouri,	294	73	244	21	141	48	117	58	Lewis and Clark.
Council Bluffs,	151	53	101	246	134	61	71	196	Dr. Lovell.
Fort Howard,	23	26	535	13	3	6	384	23	Dr. Lovell.
Fort Crawford,	250	53	101	190	137	10	33	186	Dr. Lovell.
New Harmony,	124	166	221	155	65	33	101	131	Dr. Troost.
Cincinnati,	211	77	343	22	135	26	164	22	Dr. Drake.
Washington City,	257	72	238	96	90	14	165	65	Rev. Mr. Little.
Baltimore,	303		208		295		194		Lewis Brantz.
Philadelphia,	227	120	255	58	69	32	196	49	James Young.
Germantown,	194.3	301	167	49	64	78.5	97	48	Reuben Haines.
New York,	301	69	210	130	134	29	116	24	Dr. Lovell.
Newport, R. Island,	218	61	335	66	89	33	112	101	Dr. Lovell.
Eastport, Maine.	229.7	159	123	234	26	69	68	109	Dr. Lovell.
	3454	1638	3693	1231	1929	593.5	2102	1190	

This table contains a summary of several separate tables inserted in "Darby's View of the United States," and drawn from documents afforded by the persons whose names are annexed. Taken either individually or collectively, the great prevalence of western over all other winds, is shown entirely across the continent, and over a zone of upwards of 40 degrees in breadth. Such coincidence, remarkable in itself, is rendered much more so by the following:

TABLE XX.

Table of the prevalent winds over the North Atlantic Ocean, from observations made by John Hamilton, during 26 *voyages made to and from Europe, principally between Philadelphia and Liverpool, between the years* 1799 *and* 1817 *inclusive.* American Philosophical Transactions. New Series, Vol. II. page 140.

Month.	No. of Yrs. of observation.	No. of Days.	W.	N.	S.	E.	Variable
January	5	98	45	20	8	15	10
February	5	135	69	13	19	22	12
March	10	198	105	22	19	38	14
April	9	234	150	31	11	25	17
May	11	264	132	27	22	64	19
June	6	172	88	8	23	33	20
July	7	125	70	12	12	21	10
August	9	223	129	18	16	29	31
September	7	159	75	28	10	28	18
October	4	144	83	14	5	26	16
November	5	98	60	6	5	23	4
December	8	179	95	9	17	37	21
			1101	208	167	361	192
Reduced to proportions of 1000.			$\frac{542}{1000}$	$\frac{102}{1000}$	$\frac{82}{1000}$	$\frac{177}{1000}$	$\frac{94}{1000}$

TABLE XXI.

Table of the prevalence of western winds at Paris.

	1816	1817	1818	1819	1820	1821	1822	1823	1824	1825	1826
Jan.	16	16	22	18	11	11	21	7	17	12	4
Feb.	17	24	11	22	7	3	10	19	12	15	14
Mar.	16	17	24	17	12	21	19	20	15	10	9
Apr.	12	10	9	12	13	11	12	14	16	13	21
May	18	17	11	13	17	21	12	15	18	14	13
June	20	19	16	21	19	14	15	19	11	14	8
July	20	27	15	12	20	26	24	25	16	10	17
Aug.	18	19	18	13	20	20	22	20	20	22	13
Sep.	16	8	16	15	15	23	15	16	13	17	17
Oct.	13	6	6	16	16	19	13	15	12	18	17
Nov.	14	18	15	16	9	19	21	9	22	23	17
Dec.	18	14	4	17	13	19	5	23	27	15	19
	198	195	167	192	172	211	189	202	201	183	169

No. 21 was constructed from the Meteorological tables in *Les Annales de Chimie et la Physique*, and shows, that at Paris, during 3996 consecutive days, the winds from the western side of the meridian amounted to upwards of one half, and in several years to above four-sevenths of the whole aerial currents. Are not the orchards of France, similar to those of the United States, inclined to the eastward?

Since the construction and publication of the preceding tables, the author of this article commenced a series of observation at his residence near Sandy Spring, Montgomery county, Maryland, from which the following table was constructed.

TABLE XXII.

Prevalent winds at the White Cottage, near Sandy Spring, N. Lat. 39° 11′;—*with monthly mean temp.*

Year.	Month.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.	W. Winds.	Reduced to proportions of 1000.	Mean Temp. Month.
1828	Nov. 6th	12	4	7	0	0	1	1	0	23	928	40°
	Dec.	11	2	14	0	3	0	1	0	27	871	39.33
1829	Jan.	13	0	6	0	2	3	6	1	19	613	30.4
	Feb.	16	0	4	0	3	0	5	0	20	714	25.23
	March	18	0	6	0	6	0	1	0	24	774	37.16
	April	16	0	8	0	3	0	0	0	24	800	51.41
	May	8	0	13	0	6	1	3	0	21	677	64
	June	11	0	6	0	8	0	1	0	17	566	69.81
	July	8	0	14	1	4	0	4	0	22	709	70.35
	August	7	1	5	2	8	0	7	1	13	419	71.04
	Sep.	11	0	8	2	1	1	4	3	19	633	61.44
	Oct.	8	0	5	1	9	0	7	1	13	419	52.87
	Nov.	13	0	11	1	2	1	1	1	24	800	39.80
	Dec.	6	3	10	2	3	0	5	2	19	613	42.58
1830	Jan.	13	1	9	2	1	0	1	4	23	742	30.03
	Feb.	9	1	6	4	2	0	4	2	16	571	34.66
	March	12	0	6	4	6	0	1	2	18	580	43.88
	April	8	1	4	3	5	4	3	2	13	433	54.49
	May	9	1	5	2	7	1	5	1	15	484	65.18
	June	12	5	7	4	2	0	0	0	24	800	68.94
	July	6	7	9	1	3	0	0	5	22	709	79.10
	August	10	2	10	1	3	0	1	4	22	709	72.72
	Sep.	12	0	5	2	8	0	1	2	17	566	63.58
	Oct.	9	3	8	2	1	0	6	2	20	645	55.48
	Nov.	10	1	3	0	6	3	5	2	14	466	51.77
	Dec.	12	2	7	1	6	0	3	0	21	677	35.53
1831	Jan.	14	3	3	0	6	1	3	1	20	645	25.81
	Feb.	18	2	3	0	3	1	0	1	23	821	25.60
	March	11	0	10	3	5	0	2	0	21	677	43.87
	April	9	2	10	0	4	2	1	2	21	700	52.48
	May	13	4	9	0	3	2	0	0	26	839	60.94
	June	4	3	9	0	7	0	1	6	16	533	71.65
	July	4	9	11	0	5	0	1	1	22	709	72.71
	August	8	4	9	1	2	1	5	1	21	677	71.06
	Sep.	9	3	9	0	4	0	4	1	21	700	63.06
	Oct.	8	7	8	0	6	0	2	1	23	742	.53.82
	Nov.	13	8	4	0	3	0	2	0	25	833	38.45
	Dec.	21	1	2	2	2	1	2	0	24	806	
	Amount.	412	80	282	42	158	23	99	49	774	671	
	Reduced to proportions of 1000.	357	68	245	36	137	19	86	42			

We could not, without some dread of public scepticism, insert this table (XXII.), if the results were not supported by so many other authorities, and amongst the rest, by observations made in the same section of the continent, as may be seen by table XXII.

TABLE XXIII.

Prevalent winds at Washington City, constructed from data afforded by the monthly tables of the Rev. Mr. Little, and reduced to proportions of 1000.

.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.	W. winds	W. w'ds with the N. w'ds added.
	410	100	190	30	47	10	149	65	700	765
	151	142	166	181	35	20	181	137	459	596
n	300	104	117	120	87	30	138	90	521	611
	270	115	190	130	40	10	165	75	575	650
	188	70	260	50	25	30	177	30	518	548
	147	40	393	70	75	00	164	40	580	620
	247	00	283	108	85	20	159	50	530	580
	221	17	327	26	180	10	221	53	565	618
	125	22	220	129	140	31	241	71	365	536
	338	40	300	55	130	7	126	87	678	765
	305	140	235	115	123	0	150	25	680	515
	369	67	154	127	102	0	140	53	590	643
t.	3071	857	2835	1141	1069	168	2011	776		

It is evident, if we compare the Washington with any other table compiled from observations made in either the United States or north-western Europe, that some local cause must operate to give so great a proportion of northern winds at Washington City. In almost every table of winds which we have examined, it was a remarkable feature that the winds from N. and S. were rare and nearly balanced each other; and that those from E. and W. presented similar comparative phenomena. Correctly indeed, in deducing their influence on aerial temperature, the north wind ought to be combined with those from the three western points; but in the table constructed from observations at Sandy Spring, this combination was neglected from the unfrequency of northern winds.

Without, however, taking the N. wind into account, the mean amount of those from the three western points, exceeds those from the five other points, as 566 is to 1000.

Both in Europe and in the United States, the course of the winds and their relative frequency and intensity, have been attributed to the relations of land and water, but actual observation proves demonstrably, that the great aerial currents similar to the tides, are, though influenced by land and water, dependent for their origin and general course upon causes above the oceanic or terrestrial subdivisions of the earth. The volumes of this Encyclopædia contain data to settle this question, part of which, to save tedious reference, we transcribe and present to the reader as part of this article.

"The third branch of the meteorology of England, respects the WINDS.* It has already been remarked, in the general observations on the climate of this country, that the W. and S.W. are much more prevalent as well as constant, than the winds from any other quarter; and this circumstance may easily and naturally be accounted for, from the situation of the island, exposed to the Atlantic Ocean. The W. and S.W winds are also the most violent, not only on the western side of the country, but also in the midland and eastern counties: so much so indeed, that the effects of their constancy and violence may generally be traced in the evident bending which they have given to the trees, in all parts of the country."

It is no presumption to say that the actual phenomenon was known to the writer of the above extract, but the cause not even suspected. In Darby's View of the United States, page 424, it is remarked, "so constantly do the prevailing currents of air set from the west over the continent of North America, that the orchards and forests generally, particularly along the Atlantic slope, invariably incline to the eastward or south-eastward. This interesting phenomenon may be seen by any person travelling along the roads, and it is in an especial manner discernible, if the traveller is passing in an E. or W. direction.

A prevalence of winds towards the ocean on North America, and from it on the British islands, must certainly depend upon some more general cause than mere oceanic approach. But we proceed with our extracts.

"From the observations made by order of the Royal Society, it was ascertained, that, at London, the state of the wind was as follows:

S.W.	S.E.	N.E.	E.	N.W.	S.	W.	N.
112	32	58	26	50	18	53	16."

From these elements, the western winds prevail at London, 215 days in the year, and are to the winds from all other points as 589 to 1000, affording an astonishing accordance with the aerial phenomena over the middle and northern part of North America.

At Liverpool, from the observations made by Mr. Hutchinson, the winds prevail from

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
13	29	18	115	9	54	49	58

western winds as 441 to 1000 of the whole.

"From these results it appears, that at Liverpool the wind blows more frequently from the S.E. than from any other point; and this circumstance at first sight may be deemed to contradict the general observations which we affirmed on the most prevalent winds in England: but Dr. Darwin, as well as Dr. Garnett, very satisfactorily ascribe this remarkable deviation at Liverpool to some atmospheric eddy, produced by the situation of the place. Enc. Vol. VIII. page 125.

"Upon an average of three years, it was ascertained that the winds at Dover have blown as follows:

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* Ency. Vol. VIII. page 524, Article ENGLAND.

N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.
91	35	195	8	37	18	118	27

From these elements the three western winds are at Dover 321 out of 529, or 606 to a thousand.

"At Lancaster, by Dr Campbell's observations, upon an average of seven years, the winds were:

N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.
26	92	47	51	35	17	67	30

Giving to the western winds 452 in a thousand.

"At Sidmouth in Devonshire, the result of 406 observations on the winds was as follows:

N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.
66	38	95	42	58	13	40	54

Here we find the western winds prevailing 199 days in the year, or 546 in a thousand.

"According to a meteorological register kept by Major Rooke for sixteen years, from 1785 to 1800, inclusive, the most frequent winds in England blow from the S.W. and N.W.; and during the last eight years of this period, the south-west winds were observed to be more prevalent, and those from other quarters to be less so; while the average number of days in which the north-east wind prevailed, appears to have been much the same during both periods. This statement, as far as regards the prevalence of the north-west winds, is certainly at variance with the observations of all other meteorologists; since the wind from this quarter more seldom occurs in all parts of England, than from any other quarter, with the exception of the south and the east in some parts of the island."*

Winds of Scotland.†—"The following comparative view of the winds on the east and west coast, has been given by Sir John Sinclair.

N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.
19	102	105	9	14	62	29	25

Westerly winds 226 in 365, or 619 in a thousand.

"According to the observations of Professor Playfair the state of the winds were in

	Days of W. wind.	*Reduced to proportions of* 1000.
1795	231 - - -	632
1796	253 - - -	693
1797	256 - - -	701
1798	250 - - -	684
1799	211 - - -	578
	Mean, -	657$\frac{3}{5}$

"At Drymen in Stirlingshire, on an average of 14 years from 1795, the winds were as follows:

Between north and east, -	105½
North and west, - - -	91½
South and east, - - -	29½
South and west, - - -	137."

Western winds, 228 days of the year, or 624 in a thousand.

At Longforgan, on the Tay, the following are the average results of 12 years:

N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.
19	102	105	9	14	62	29	29

Here the western winds amount to 226 in the year, or 619 in a thousand.

In West Lothian in 1828, the winds were as follows: from Westerly points 232
Easterly 120
Due north 10
Due south 3; or westerly winds 635 in 1000 of the whole winds.

The following table is very remarkable as confirming the suggestion of Major Rooke, on the prevailing winds in England.

This table shows the state of the winds at Kinfauns, at 8 o'clock in the morning.

TABLE XXIV.

Winds at Kinfauns Castle, Seat of Lord Gray, Scotland, from 1813 *to* 1825 *inclusive.*

Direction of the Wind.	1813	1814	1815	1816	1817	1818	1819	1820	1821	1822	1823	1824	1825
N. and N.E.	10	3	9	32	25	19	28	19	10	11	4	15	9
E. and S.E.	76	109	102	105	91	132	109	97	132	119	122	110	119
S. and S.W.	101	65	85	62	133	93	60	67	45	68	59	55	95
W. and N.W.	178	188	169	167	116	121	168	183	178	167	180	186	143

"From the numbers in this table, we obtain the following results for 13 years (as an annual average):

North and north-east, - -	15 days
East and south-east, - -	102 "
South and south-west, - -	76 "
West and north-west, -	172 "."

Combining the two latter, we have as western and southern winds 248; from which, deducting the one-tenth, about the usual proportion, for wind due south, we have for westerly winds 223 and two-tenths, or 612 in 1000.

But what renders the element in table 24 in a peculiar manner deserving notice, is the fact, that the current of air from west and north-west, amounts to 449 in a 1000 of the whole winds, corresponding in a striking manner with the most prevailing current of the atmosphere on North America; and strongly supporting the results found by Major Rooke as the aerial phenomena of England.

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[*] Encyclopædia, Vol. VIII. p. 256.

[†] Encyclopædia, Vol. XVI. p. 746.

TABLE XXV.

Winds of Ireland.

Prevalent winds at Dublin for a space of upwards of forty years.

Seasons.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.
Spring	126	129	148	18	129	74	111	54
Summer	139	182	199	29	134	74	62	32
Autumn	119	200	165	31	108	39	51	47
Winter	73	157	176	8	146	39	52	24
Amount.	457	668	688	86	517	226	276	157

Here the western have to all other winds a proportion of 524 to 1000.

TABLE XXVI.

Winds at Londonderry, from 1795 to 1801 inclusive.

Years.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.
1795	109	79	83	38	60	26	62	31
1796	101	103	69	33	49	42	45	32
1797	55	98	82	51	50	16	29	19
1798	42	100	98	68	57	34	23	26
1799	67	109	70	34	56	34	16	49
1800	79	136	36	27	75	21	27	41
1801	86	141	36	46	29	36	23	37
	539	766	479	297	376	209	225	225

Table XXVI. gives a mean prevalence to the western, over all other winds, of 563 in 1000.

TABLE XXVII.

Summary of the Winds of North America and of the north-western part of Europe.

Place of Observation.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	N.	W. wind reduced to proportions of 1000.
Basin of Columbia,	118	44	401	33	200	53	130	20	563
N. Polar Sea,	394	$79\frac{3}{4}$	132	32	112	28	122	100	605
Fort Brady,	159	274	79	86	241	73	32	58	542
Valley of Missouri,	294	73	244	21	141	48	117	58	611
Council Bluffs,	151	53	101	246	134	61	71	196	305
Fort Howard,	23	26	535	13	3	6	384	23	584
Fort Crawford,	250	53	101	190	137	10	33	186	404
New Harmony,	124	165	221	155	65	33	101	131	510
Cincinnati,	211	77	343	22	135	26	164	22	631
Washington City,	257	72	238	96	90	14	165	65	567
Sandy Spring,	351	68	245	36	137	19	86	42	671
Baltimore,	303		208		295		194		511
Philadelphia,	227	120	255	58	69	32	196	49	602
Germantown,	$194\frac{1}{3}$	301	167	49	64	$78\frac{1}{2}$	97	48	$662\frac{1}{3}$
New York,	301	69	210	130	134	29	116	24	580
Newport, Rhode Island,	218	61	335	66	89	33	112	101	614
Eastport, Maine,	$229\frac{2}{3}$	159	123	234	26	69	68	109	511
North Atlantic Ocean,		1101		167		361		208	542
Paris, France,									517*
London, England,	50	53	112	18	32	26	58	16	589
Liverpool,	58	49	54	9	115	18	29	13	441
Dover,	91	35	195	8	37	18	118	27	606
Lancaster,	26	92	47	51	35	17	67	30	452
Sidmouth,	66	38	95	58	58	19	40	54	546
Scotland, by Sir John Sinclair,	19	102	105	9	14	62	29	25	619
Scotland, Playfair,									$657\frac{3}{5}$
Drymen, Near Stirling,									624
Longforgan,	19	102	105	9	14	62	29	25	619†
West Lothian,									635
Kinfauns Castle,									612
Dublin, Ireland,	457	668	688	86	517	226	276	157	524
Londonderry, Ireland,	539	766	479	297	376	209	225	225	563

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* See Table No. XXI.

† The numbers in this column seem to be the same as those in that headed by the name of Sir John Sinclair

The results of this summary table, and those from which it is constructed, would render excusable a suspicion that the elements were selected to support a theory, but so far from such a process having been followed, the elements were arranged as they presented themselves, and many of the most important are scattered over the volumes of this Encyclopædia, in reach of the reader; the correctness of our application may therefore be tested. Errors of calculation there may be, but they are involuntary, and we trust not of such extent as to seriously influence the aggregates.

If, as we assume, these tables of the winds are taken as solid data, the true cause of the great difference of temperature between given latitudes on North America, and North-western Europe is determined. We find from table 27, that the three western winds over the former section of the earth are, to all other aerial currents, as 556 to 1000, on a mean from the Pacific to the Atlantic ocean; and that, also on a mean, the three western winds prevail over North-western Europe, as 571 to 1000. If the northern winds were included with the western, as in reality they might have been correctly, on both continents, the result would remain nearly the same as already deduced.

To the American Almanac for 1832, page 98, the following is appended as a note.

"The number of days required by the packets between Liverpool and New York, to make the passage outwards and homewards, places this (the author's observations on the trade wind in the text) in a striking point of view:

"The average of the whole of the passages made by the packets, in six years, from Liverpool to New York, that is from east to west, is 40 days.

"The average, during the same period, of the same vessels, from New York to Liverpool, or from west to east, is 23 days."

These voyages give a prevalence to west over all other winds of 606 in a 1000, agreeing in an astonishing manner with the results in table 27.

According to Professor Playfair, and other authorities, the winds blow almost incessantly from the south-eastern coast of Asia towards the Pacific ocean.

Can there be any farther hesitation in ascribing the intense winters of North America, to that prevailing and powerful current of air borne from an immense snow covered and frozen continent? Or can there exist a doubt, but that the comparatively uniform temperature of North-western Europe is produced by the immense preponderance of western winds from a wide and perennially open ocean? Again, is it not now demonstrated, that the winds of both continents do not depend for their general course, on either land or water?

It may be also remarked, that the prevalence of western and north-western winds is really but very slightly influenced in their respective occurrence by the seasons of the year. It is not, however, to the actual prevalence of the western currents of air that their overwhelming agency is entirely to be attributed; their relative intensity must be taken into comparison. According to Mr Hutchinson's observations at Liverpool, (see vol. viii. page 525, 2d column) the west wind blew with most rapidity and force, and next to it in violence, were those of the south-west and north-west. These conclusions accord perfectly with the same winds of North America above N. Lat. 35°, and there can be no risk in stating, that if we suppose the whole power of the wind to be represented by 1000, and if we add their force to their occurrence; the western winds comprise at least the seven-eighths of the whole aerial stream over the space embraced in our estimates. The bending of the trees on both continents, already alluded to, is a phenomenon obvious to the most careless observer. Before drawing our final conclusion, we proceed to give some of the best authenticated results obtained by observations made with the Thermometer. An opinion has long prevailed, and to considerable extent still prevails, that the valley of Ohio in particular, and the basin of the Mississippi generally, has an aerial temperature considerably higher than is experienced on corresponding latitudes along the Atlantic slope of the United States. Such an error, for such it is, is far from being one of those innocent conclusions in opposition to obvious facts; it has greatly contributed to emigration; and we shall soon see, that so contrary is reality, that what might be expected is true; the mean and extreme temperature increase with height and exposure, over the Mississippi basin, as they do every where else on earth. The authorities on which the mean temperature is deduced are named in the tables, but we preface those respecting the United States by extracts from the preliminary remarks to Lovell's Meteorological Register, dated Washington, September 1826.

"The posts at which these observations were made are situated between 27° 57′ and 46° 39′ of north latitude, and between 67° 04′ and 95° 43′ of longitude west from Greenwich; embracing an extent of 18° 42′ of latitude, and 28° 39′ of longitude. The elevation of the north-western, or interior, stations above those on the Atlantic coast has not been accurately ascertained; the following however is believed to be near the truth. Fort Brady, situated at the outlet of Lake Superior, is 595 feet above the level of tide water; Fort Howard, at the southern extremity of Green Bay, which empties into Lake Michigan, 600 feet; Fort Crawford, at Praire du Chien, near the junction of the Wisconsan and Mississippi rivers, 580 feet; Fort Snelling, near the junction of the St. Peter and Mississippi rivers, 780 feet; Council Bluffs, a few miles above the junction of the Platte and Missouri rivers, 800 feet. Baton Rouge, on the Mississippi, 120 miles above New Orleans, and Cantonment Jesup, near the Sabine river, 25 miles from Natchitoches, are in Louisiana; Cantonment Clinch near Pensacola, Cantonment Brooke near Tampa Bay, and St. Augustine, in Florida. Fort Moultrie is in the harbour of Charleston, South Carolina; Fort Johnston near Smithville, North Carolina; Fort Severn at Annapolis, in Maryland; Fort Mifflin in the Delaware, 6 miles below Philadelphia; Fort Columbus in the harbour of New York; Fort Wolcott in the harbour of Newport; and Fort Sullivan near Eastport, in the State of Maine. The observations at the city of Washington are introduced by way of comparison, as the latitude of this city is very nearly the same with that of the centre of the several military posts. They were made by the Rev. Mr. Little, by whom they were very politely furnished for the present purpose."

A.M. VII., and P.M. II. and IX., are given in Lovell's Register as the hours of observation, and the results of course too high, particularly in high latitudes. In midsummer between Lat. 44°, and 45°, the sun is upwards of three hours above the horizon at seven o'clock, A.M. and has set only about one hour and a quarter at nine o'clock, P.M. But the cause of excess being general, so must be the excess itself, admitting a common correction.

TABLE XXVIII.

Comparative view of mean temp. from Lovell's Register.

PLACE.	COUNTRY.	North latitude.	Longitude, London.	Mean temperature.
Petersburg,	Russia near the level of the sea,	59 56	30 24 E.	38 80
Stockholm,	Sweden near the level of the sea,	59 20	18 00 E.	42 39
Edinburgh,	Scotland, partially, but not much above,	55 57	3 00 W.	47 70
Berlin,		52 32	13 31 E.	49 00
Leyden,		52 10	4 32 E.	52 25
London,		51 31		51 90
Rouen,		49 26	1 00 W.	51 00
Paris,		48 50	2 25 E.	52 00
Vienna,	About 500 feet above the ocean,	48 12	16 22 E.	51 53
Nantes,	On the line of France,	47 13	1 28 E.	55 53
Poitiers,	France,	46 39	0 30 E.	53 80
Fort Brady,	Outlet of Lake Superior, 595 feet,	46 39	84 43 W.	41 37
Padua,	Italy,	45 23	12 00 E.	52 20
Fort Snelling,	Mississippi river, 780 feet,	44 53	93 08 W.	45 00
Bourdeaux,	Western part of France,	44 50	0 26 W.	57 60
Fort Sullivan,	Near Eastport, Maine,	44 44	67 04 W.	42 44
Fort Howard,	Green Bay elevated 600 feet,	44 40	87 00 W.	44 50
Marseilles,		43 19	5 27 E.	61 80
Fort Crawford,	On Mississippi river, 580 feet,	43 03	90 53 W.	45 52
Fort Wolcott,	Newport, Rhode Island,	41 30	71 18 W.	51 02
Council Bluffs,	Missouri, 800 feet,	41 25	95 43 W.	50 82
Pekin,		39 54	116 29 W.	55 50
Washington,		38 53	76 55 W.	56 56
Algiers,		36 49	2 17 E.	72 00
Fort Johnson,	Near Smithville, mouth of Cape Fear river,	34 00	78 05 W.	66 68
Cantonment Clinch,	Near Pensacola,	30 24	87 14 W.	68 77
Grand Cairo,		30 00	31 23 E.	73 00
St. Augustine,		29 50	81 27 W.	72 23

TABLE XXIX.

Comparative view of mean temperature along the Atlantic slope, and interior basin of the United States, as also of the North American Polar Sea, corrected by the observations of Haines, Little, Brantz and others, on the former, and Lewis and Clark, Captain Parry, Drs. Drake and Troost, &c. of the interior section.

PLACE.	PHYSICAL SECTION.	N. Lat.	Long.	Mean Temp.
Eastport,	State of Maine and mouth of St. Croix river,	44 55	10 00 E.	42 44
Boston,	Massachusetts, bottom of the Bay of same name,	42 38	5 48 E.	46 00
Newport,	Near the Atlantic Ocean and mouth of Narragansett,	41 31	5 32 E.	51 00
New York city,	Mouth of Hudson river,	40 42	2 56 E.	51 60
Philadelphia,	On the Delaware, about 60 miles inland,	39 57	1 48 E.	52 36
Baltimore,	Baltimore, about 90 miles inland,	39 18	0 23 E.	55 00
Sandy Spring,	Sandy Spring, elevated above tide 400 feet, and on table land between the basins of Potomac and Patuxent.	39 10		52 77

TABLE XXIX. continued.

PLACE.	PHYSICAL SECTION.	N. Lat.	Long.	Mean Temp.
Washington city,	Sixty or seventy feet above tide water in Potomac,	38 53		53 50
Annapolis,	West shore of Chesapeake Bay,	39 00	0 32 E.	53 50
Smithville,	North Carolina, and on Atlantic Ocean, mouth of Cape Fear river,	34 53	0 07 W.	57 50
Charleston,	About five miles from, and nearly level with the Atlantic,	32 44	3 00 W.	59 10
St. Augustine,	On and nearly level with the Atlantic Ocean,	29 48	4 32 W.	65 05
Pensacola,	Eight miles N. from, and but little above the Mexican Gulf,	30 23	10 20 W.	58 77
New Orleans,	On the left bank of the Mississippi and not above 4 feet in any part above tide water in the Gulf of Mexico,	30 00	13 00 W.	66 50
Baton Rouge,	On left bank of Mississippi, and slightly elevated; 50 feet?	30 28	14 18 W.	65 00
Sabine river,	Elevated perhaps sixty feet,	31 30	16 42 W.	64 00
St. Louis,	On right bank of Mississippi; elevation 350 feet,	38 36	13 15 W.	53 50
Fort Crawford,	Junction of the Mississippi and Onisconsin rivers,	43 03	14 12 W.	45 52
Fort Brady,	Straits of St. Mary,	46 39	7 21 W.	41 37
Council Bluffs,	Bank of Missouri, elevated 800 feet,	41 30	18 45 W.	50 82
Fort Snelling,	Near union of Mississippi and St. Peter's rivers,	44 53	16 42 W.	45 00
New Harmony,	Wabash river, and elevated about 450 feet,	38 10	11 00 W.	52 00
Cincinnati,	Cincinnati on the Ohio, from 500 to 600 feet,	39 52	7 30 W.	54 00
Pittsburg,	Pittsburg, elevated above tide water 648 feet,	40 28	2 56 W.	50 00
North Polar Sea,	In the North American Arctic Ocean,			

TABLE XXX.

Comparative view of mean temperature on Northern Africa, and in Europe as far eastward as St. Petersburg; compiled from Malte Brun's Geography, Edinburgh Encyclopædia, &c.

PLACE.	PHYSICAL POSITION.	N. Lat.	Long. from London.	Mean Temp. Fahr.
Grand Cairo,	On the lower basin of the Nile,	30° 03′	31 18 E.	73 00
Algiers,	On the northern coast of Africa,	36 49	2 17 E.	72 00
Palermo,	On the northern coast of Sicily,	38 12	13 25 E.	62 18
Rome,	S.W. slope of Italy, and but little above the sea,	41 52	12 30 E.	59 43
Lisbon,	W. side of Spanish Peninsula, and on the Tagus,	38 43	9 10 W.	61 70
Madrid,	Table land of Spain, and basin of the Tagus,	40 23	3 47 W.	53 60
Marseilles,	In the middle S. coast of France, and on the Mediterranean,	43 25	5 30 E.	59 00
Vienna,	Upper sub-basin of the Rhone,	45 33	5 05 E.	54 14
Geneva,	Middle part of the basin of the Rhone,	46 12	6 50 E.	49 62
Milan,	Middle part of the basin of the Po,	45 30	9 12 E.	55 76
Zurich,	On the Swiss table land, elevated 1200 feet,	47 10	8 30 E.	47 71
Berne,	Swiss table land, elevated 1200 feet,	46 57	7 30 E.	48 27
Ratisbon,	In the higher Danube basin, 1000 feet above the sea,	48 58	12 05 E.	48 00
Vienna,	On the Danube, elevated 500 feet above the sea,	43 12	16 20 E.	50 54
Buda,	Basin of Hungary, and on the Danube,	47 32	19 E.	50 81
Paris,	Northern slope of France,	48 30	2 24 E.	50 52
Laon,	Northern slope of France and basin of the Seine,	49 25	3 40 E.	47 30
St. Malo,	N.W. coast of France, and on the British channel,	48 30	1 46 W.	54 14
Nantes,	W. slope of France and basin of Loire,	47 07	1 45 W.	54 68
Bourdeaux,	On the Garonne river, W. slope of France,	44 50	0 26 W.	56 48
Clermont,	E. foot of Mount D'Or,	45 40	3 10 E.	50 00
Brussels,	Great undulating plain of the Netherlands,	50 51	4 18 E.	50 09
Hague,	Almost on the shore and level with the German Ocean,	52 04	4 23	49 64

TABLE XXX. continued.

PLACE.	PHYSICAL POSITION.	N. Lat.	Long. from London.	Mean Temp. Fahr.
Leyden,	Near the German Ocean and a little above it,	52 10	4 25 E.	49 64
Berlin,	Northern plains of Germany,	52 30	13 20	46 76
Warsaw,	On the vistula elevated about 600 feet above the sea,	52 12	21 10	48 56
Prague,	On the table land of Bohemia, 1000 feet,	50 08	14 35	49 46
Copenhagen,	On the sound between the Baltic and Cattegat seas,	54 40	12 25	45 35
Stockholm,	On the Maeler lake, E. slope of Sweden,	59 23	18 00 E.	42 26
Upsala,	E. slope of Sweden,	59 50	17 30 E.	44 70
St. Petersburg,	On the Neva river, between the gulf of Finland and lake Ladega,	59 56	30 25 E.	38 84
Umea,	E. slope of Sweden, and on the gulf of Bohemia,	63 05	19 18 E.	33 26
Abo,	S. W. slope of Finland, and on the E. shore of the Baltic,	60 27	22 18 E.	42 80
Bergen,	W. slope of Norway, and near the Atlantic Ocean,	60 11	6 00 E.	45 00
Christiana,	S. and sheltered valley of Aggerhuys, Norway,	59 58	10 50 E.	42 80
Dover,	S.E. coast of England, and on the channel,	51 10	1 20 E.	53 00
London,	On the Thames, S.E. slope of England,	51 31	76 55 E. W.C.	48 41
Sidmouth,	S. slope of England, and on the British channel,	50 42	3 20 W.	47 00
Liverpool,	Western slope of Britain,	53 27	3 05 W.	46·00
Kendal,	Western slope of Britain,	54 20	2 48 W.	46 08
Lancaster,	Western slope of Britain,	54 05	2 46	51 80
ENGLAND,	Island including Wales and Scotland, extending from S. to N. greatest length to mean breadth, as 4 to 1 nearly,	54 00 to 58 45	1 45 E. to 6 20 W.	46 33
Edinburgh,	E. coast of Scotland,	55 58	3 00 W.	46 33
Huntley Lodge,	440 feet above the sea,	57 24	2 57 W.	45 93
Inverness,	Near to and exposed to the German Ocean,	57 29	4 12 W.	44 70
St. Andrews,	78 feet above the Sea; E. slope of Scotland,	56 20	2 49 W.	47 00
Lead Hills,	1280 feet above the sea,	55 25		43 70
Kinfauns,	E. slope of Scotland, and near the sea,	56 23	3 12	46 35
SCOTLAND,	Or that part within the scope of the preceding observations,	55 25 to 57 29		45 67
Dublin,	Near the extreme E. coast of Ireland,	53 20	6 20 W.	49 05
Armagh,	N.E. part of Ireland, 30 miles inland,	54 18	6 45 W.	47 50
Belfast,	N.E. coast of Ireland,	54 38	6 05 W.	53 00
Londonderry,	Near the extreme northern coast of Ireland,	55 00	7 30 W.	46 90
IRELAND,	Extending from S.S.W. to N.N.E. greatest length to mean breadth, as 3 to 1 nearly,	51 10 to 55 20	5 35 W. to 10 40 W.	48 90

The first observation which will strike the reader on comparing the latitudes and mean temperature in Table XXIX. and XXX., will probably be, that the latter decreases retiring from the coast on both continents, and might naturally superinduce a conclusion that the cause of high temperature depended on proximity to the ocean. The true cause has been demonstrated under the head of Wind.

To institute a fair comparison between the respective temperature on the two opposing shores of the Atlantic Ocean, we now take the mean of twelve places on or near the coasts of the two continents.

On North America, from Eastport in Maine to St. Augustine inclusive, there are in Table XXIX. twelve places along the Atlantic, all situated below or at the head of the tides. The extremes include a small fraction above 15 degrees of latitude, the mean of which is N. Lat. 37° 20′, and mean of the individual mean temperatures, is 53° 2′ very nearly; not differing materially from the mean given for Washington City.

Taking twenty-two places along or near the European coast from Lisbon in Portugal to Bergen in Norway, including 21½° of latitude, and whose mean latitude is 49½ very nearly, the mean temperature comes out 49° 38′, answering in a very remarkable manner to the latitude and mean temperature along the British channel.

There are, we must premise, discrepancies in the elements from which the tables are constructed which forbid decisive inductions, but sufficient reliance may be placed on the aggregates to yield very satisfactory conclusions. In regard to mean temperature we find there is a difference between the North American and European coasts, of about nine degrees of Fahrenheit, or five degrees of the centigrade thermometer.

Those great extremes of difference, less, however, than generally suposed, are only maintained on, or at no considerable distance from the coast. This truth may be seen by examining, and comparing the tables. The plateaus or table lands of Europe, such as central Spain, France, Switzerland and Bohemia, do not on like latitudes enjoy a much, if any, higher temperature than is found in the United States.

We now proceed to close these comparative views by stating the extremes of temperature on both continents. We cannot avoid remarking in this place, that the extremes of temperature are much more decisive of the contrasts of climate than are the mean terms; and, farther, that in a great majority of instances, extremes, being phenomena out of the ordinary course, are by far more correctly observed, than are the more common changes.

It has already been shown, in this article, that the results in Dr Lovell's Register, were too high, yet, the following, from these otherwise valuable tables, show the excessive extremes of temperature observed in the United States.

TABLE XXXI.

Latitude, Longitude from Washington City, elevation above the Atlantic Ocean, with the mean and extreme temperature of places in the United States.

Names of places with their Local Positions.	Height above the Atlantic Ocean.	N. Lat.	Long. from W.C.	Revolutions of temperature as shown by Fahrenheit's ther.				
				Max	Min.	R'nge.	Mean.	General Remarks.
Fort Brady, near Falls of St. Mary, Mich. Territory,	595	46° 39′	7° 21′ W.	90	—33	123	41° 37′	In 1823 —30; 1824 —33; and in 1825
Fort Howard, S. extremity Green Bay,	600	44 40	10 00 W.	100	—38	138	44 50	In 1822 —23; 1823 —38; 1824 —1 in 1825 —25.
Fort Crawford on Mississippi, Prairie du Chien,	580	43 03	13 58 W.	96	—28	124	45 52	On the point above the junction of consin and Mississippi rivers.
Fort Snelling, junction of St. Peter's and Mississippi rivers,	780	44 53	16 13 W.	96	—29	125	45 00	On the point above the junction Peter's and Mississippi rivers.
Council Bluffs, on Missouri river, above Platte,	800	41 25	18 48 W.	108	—21	129	50 82	Mean temp. inconsistent with t tremes; —46°?
St. Louis, calculated by approximation,	450	38 46	12 58 W.				55 86	Excessively exposed to wind and ext of temp.
New Harmony, Wabash river, Dr. G. Troost,	400	38 11	10 50 W.	96	— 5	101	56 74	
Cincinnati, on Ohio river, Dr. D. Drake,	500 to 600	39 06	7 25 W.	98	—18	116	53 56	The S.W. wind violent every wh the Ohio.
Philadelphia, in the city of, Jas. Young,	50	39 57	1 47½E.	98	— 2	100	58 41	The local warmth of the city of Ph phia accounts for the great disc cy with the mean at Germantown peculiar course of the two riv counts for a similar discrepancy winds of the two places.
Germantown, Reuben Haines,	200	40 03	1 45 E.	96	—10	106	52 03	
Fort Mifflin, 6 miles below Philadelphia,		39 52	1 43 E.	96	+ 6	90	55 28	
N. York, Fort Columbus, Fort Wolcott,		40 42	2 53 E.	104	— 3	107	51 60	The course of the North river d the N.W. into a N. wind, and th See Table 27.
Newport, Rhode Island, Fort Wolcott,		41 30	5 37 E.	88	— 1	89	51 00	Narragansett Bay superinduces a s remark to that made respecting river at New York.
Eastport, Maine, Fort Sullivan,		44 44	10 00 E.	94	—19	113	42 44	The very rapid and great increase towards the N.E. section of the States, must depend on a great posure to N.W. wind. See h Mountains in this article.
Baltimore, Lewis Brantz,	50	39 18	0 23 E.	98	— 6	104	53 00	Mean of eight years.
Sandy Spring, Wm. Darby and others,	400	39 10		90	—13	103	52 77	There occur but few winters in the extreme cold is not very near low the zero of Fahr. At this Dec. 16th, 1831, Wm. Darby's mometer showed a depression Dr. Howard's —12; and James ants' —13. Dr. Palmer's, gradu 7—, was in the bulb.

TABLE XXXI. continued.

mes of Places with their Local Positions.	Height above the Atlantic Ocean.	N. Lat.	Long. from W.C.	Revolutions of temperature as shown by Fahrenheit's ther. Max.	Min.	R'nge.	Mean.	General Remarks.
ington City, the Rev. Mr. Little,	50	38 53	0 00	95	—10	105	53 50	Two thermometers, Dec. 16, 1831, —10
ond, Virginia, J. A. Chevallie,	60?	37 04	0 26 W.				56 10	Mean of 4 years.
olis, Maryland, W. side of Chesa- e Bay,		38 58	0 28 E.	92	+ 8	84	57 40	Lovell's Register for 1822 only.
ville, mouth of Cape Fear river, C.		34 00	1 10 W.	92	+26	66	54 53	The mouth of Cape Fear river, dwarf-live oak appears.
eston, South Carolina, Drayton, &c.		32 42	3 01 W.	92	+19	73	59 10	The mean of Charleston, deduced from Drayton's tables, compared with the mean of Washington city.
gustine, eastern shore of Florida,		29 50	4 32 W.	94	+42	52	65 50	Lovell's Register for extremes;—lowest certainly too high, as frost and ice are frequent at St. Augustine.
a Bay, western shore of Florida,		27 57	5 40 W.	92	+40	52	65 00	Calculated comparatively.
cola, near the northern shore of f of Mexico,		30 24	10 20 W.	95	+11	84	58 75	Ice frequent, and snow occasionally.
Orleans, on the Delta of the Missip.		30 00	13 00 W.				66 50	The writer of this has seen ice nearly an inch thick at New Orleans; snow occasionally; and more or less frost nearly every winter.
Rouge, first high land ascending sissippi,	30	30 28	14 18 W.	99	+18	81	65 00	Similar to New Orleans, except colder and more snow.
e cavity, banks of,	60?	31 30	16 42 W.	97	+ 7	90	64 00	Too high, no doubt. I have seen very severe frost at the mouth of Sabine, at 29° 18′ N.

It was our intention to have given a general table of the monthly mean temperature, but such are the inequalities of the same month in different years as to render generalisation on the subject very unsatisfactory. So unlike indeed are the years both as to extremes of temperature, and moisture, that to reach any decided conclusion demands a mean of a long cycle. The last three years have for so short a period, afforded very wide extremes, therefore we present the following comparative tables of the seasons.

TABLE XXXII.

Table of Mean Temperature of the Seasons at Sandy Spring, N. Lat. 39° 10′.

Winter of 1828—29.—Mean temp. from winter solstice 1828, to vernal equinox 1829, - - - - - - - -	29.39°
Spring of 1829.—Mean temp. from vernal equinox 1829, to summer solstice 1829,	58.22
Summer of 1829.—Mean temp from the summer solstice, to the autumnal equinox 1829. - - - - - -	69.31
Autumn of 1829.—Mean temp. from autumnal equinox, to winter solstice 1829,	46.96
Winter of 1829—30.—Mean temp. from winter solstice 1829, to vernal equinox 1830, - - - - - - - -	35.63
Spring of 1830.—Mean temp. from vernal equinox, to summer solstice 1830,	58.14
Summer of 1830.—Mean temp. from summer solstice, to autumnal equinox 1830,	71.46
Autumn of 1830.—Mean temp. from autumnal equinox, to winter solstice 1830,	49.23
Winter of 1830—31.—Mean temp. from winter solstice 1830, to vernal equinox 1831, - - - - - - - -	29.88
Spring of 1831.—Mean temp. from vernal equinox, to summer solstice 1831,	59.64
Summer of 1831.—Mean temp. from summer solstice, to autumnal equinox 1831,	69.95
Autumn of 1831.—Mean temp. from autumnal equinox, to winter solstice 1831,	41.81
Mean of the above 12 seasons, - -	51.63

Combining this mean with that produced by observations made monthly during the same period on perennial springs, the mean temperature at Sandy Spring comes out 52.776° or 52¾° Fahrenheit.

The following table compiled from Malte Brun will show, as far as the respective elements are correct, the contrast between the seasons of the United States and Europe.

TABLE XXXIII.

Mean temperature of the Seasons at several places in Europe. Malte Brun, Vol. VI. p. 69, Boston octavo edition, Wells and Lilly. Degrees of the original Centigrade reduced to Fahrenheit's Scale.

Seasons.	Upsal.	Copenhagen.	Edinburgh.	London.	Paris.	Geneva.	Zurich.	Buda.	Rome.	Palermo.
Spring,	+39.57	41.84	44.28	47.42	50.12	49.60	48.43	50.99	57.52	58.60
Summer,	60.42	63.06	55.71	60.96	63.30	62.88	64.07	70.41	72.59	71.61
Autumn,	42.24	47.71	46.87	48.57	50.79	50.21	48.38	51.47	61.34	66.14
Winter,	24.55	28.76	39.58	36.64	37.86	35.74	29.93	30.47	46.31	50.35
Mean.	44.44	45.35	46.81	4850	50.52	49.62	47.71	50.83	59.44	61.67

There will be found discrepancies between this table and others in the head of Climate, but not of such magnitude as to defeat the object of the tables, which was to give a comparative view of the climates of Europe and North America. It will be seen by inspection of tables XXXII. and XXXIII., that, as has been already observed, the difference of mean temperature decreases on Europe, leaving the western coast and advancing to the interior table lands, and the following table exhibits similar phenomena as respects extreme cold.

TABLE XXXIV.

Extreme cold in Europe. From Malte Brun, Vol. VI. page 62—68, Fahr. Ther.

North-eastern part of Europe, beyond the Onega river.—Mercury is often malleable at Usting—Welecki. Rivers frozen from November to April, inclusive. Agriculture ceases about N. Lat. 60°. Pine trees cease at 61 or 62°.

Between the Gulf of Bothnia and White Sea.—Greatest cold at St Petersburg, —12.10°
Rye, barley, and wheat cultivated. The latter frequently ripens in Finland at 60°.

Lapland.—Mean temperature of summer at Cape North, Lat. 72°, 43⅓°, and at Enontikies, Lat. 69° = 54.8°.

Scandinavia:—lowest temperature at Bergen, - - - - - - - - —10.40
Upsal, - - - - - - - —22.00
Pine and Fir to Lat. 66°; oaks to 60°. Grain every where cultivated.

Central table land of Russia, or the Valday region.—Mercury was malleable the 3d of February 1803, at Saratov, on the Wolga, N. Lat. 53½°. Wolga and other rivers frozen from the month of December to April inclusive. Apple and pear trees to N. Lat. 55°.

Lower Wolga, or northern Caspian region. At Astrachan, N. Lat. 46½°, highest temperature, 96.8°, and lowest, —10.66

North side of Black Sea.—Lowest temperature at Odessa, and vicinity, N. Lat. 46¼°. - - - - - - —23.80

Poland and Eastern Germany.—Lowest temperature at Warsaw, - - - + 3.38
Lemburg or Leopol, - - - —18.40
Prague, on the basin of Bohemia, - — 6.70

Great north-western slope of Germany, including the Delta of the Rhine, Jutland, and the Danish Islands.
Brussels, lowest temp. - - - +13.20
Franeker in Friesland, near the German Sea, N. Lat. 53° 11′, - - - —11.20
Berlin on the Spree, northern great plain of Germany, - - - - - + 9.32
Copenhagen, - - - - - - +10.58

Either to the southward of the great chains of the Pyrenees, Alps, and Hæmus, or to the westward of the German Ocean, does the scale of Fahrenheit, except on mountains, or at extraordinary times, indicate a cold as low as zero. But the north-western part of Europe is subject to great and rapid changes of temp. See Art. ENGLAND, in this Encyclopædia.

Bourdeaux, coldest month, - - - +23
Nantes, coldest month, - - - - +25
Clermont, near the centre of France, coldest month, - - - - - - +30
Rome, coldest month, - - - - +42.26
Montpelier, very nearly same, - - +42.26
Spanish base of the Pyrenees, lowest temp. +22
Madrid, lowest temp. - - - - +26
Cadiz, lowest temp. - - - - +44.6

Some may deem us too minute in the selection of comparative element, but those who reflect on the erroneous opinions prevalent on the real and comparative climate of the United States, will not blame a condensation of evidence.

It may be well to state the manner in which our own element was collected. A good Fahrenheit was suspended on small iron wire, in a recess facing the north-west, and defended from the local influences of the dwelling-house, or the radiated heat of the sun. This instrument, in perhaps ninety days in an hundred, was examined in the morning as soon as the light was sufficient, and the degree indicated put on record. At, or after mid-day, the highest degree was recorded; and finally at nine or ten at night. These three observations entered in a tabular manner enabled the observer to enter a mean. The state of the weather was each day carefully recorded.

The observer, the writer of this article, from the 6th day of November 1828 to the moment of writing, January 1832, with the exception of about fifteen days, made every entry from his own observations.

The prevailing wind was also carefully observed and recorded.

Four very fine perennial fountains were chosen, and their temperature taken at intervals of 30 days nearly. On this latter mode of ascertaining mean temperature we have to observe, that if done with adequate attention, and once or twice monthly during one or more years, a very satisfactory mean may be produced. Observations of this kind, similar to all other experiments accurately made, have a tendency to remove popular error; as may be seen by reference to article METEOROLOGY, Vol. XIII., page 173, 174 of this Encyclopædia.

The observations there made on the great changes of temperature in the water of wells and fountains accord with the results obtained in the same manner at Sandy Spring.

TABLE XXXV.

Mean Monthly temperature of water at the head of perennial fountains in the vicinity of Sandy Spring.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
1829	53.62	52.25	50.69	52	52.5	53.41	53.93	55.06	55.75	55.25	53.93	53
1830	52.44	52 08	51.93	52.62	52.81	53.31	54.06	54.33	56.20	55.87	55.55	53.4
1831	53,93	52.62	52.87	52 93	53.68	53.37	54.5	55.87	55.87	55.31	54.12	54.93
Mean.	53.33	52.32	51.83	52.52	53.	53.36	54.16	55.09	55.93	55.48	54.54	53.80

One primary object in inserting this table, is to call the attention of observers to this elegant and easy mode of determining the mean temperature of the earth; which will in a period of a few years correspond remarkably with the mean of the air found by the thermometer. By reference to the head of climate in the article METEOROLOGY, the method by the water is preferred by the writer. Professor Lesley has thrown some discredit on such observations, by ascribing more to its results than they are calculated to produce; but in judicious hands they afford much the least expensive mode of determining the mean temperature.

In the American Almanac for 1832, page 85, are two expressions which our element and that under the head of Meteorology are far from supporting. "At the depth of eighty or a hundred feet, the most sensible thermometer will hardly exhibit any change throughout the year."—"The question has been much discussed, whether the winters in the temperate latitudes have become milder or not. There is abundant evidence, it seems to us, in favour of the alleged change."

In the same valuable manual, page 86, it is again suggested, that "the change, whatever it be, seems to belong to the autumn and early part of winter. The spring, we are inclined to believe, is even more cold and backward than it used to be."

The writer of the article UNITED STATES has long considered the idea of the supposed change illusory, and increasing document from actual observation demonstrates its impossibility, unless it was preceded and produced by a change in that order of nature which has prevailed coeval, and no doubt long anterior to all human observation. In fact, the best evidence proves that the destruction of forests, widens the extremes, but leaves the mean term nearly what it would be from like position or difference of position. The popular error of a supposed melioration has prevailed on both sides of the Atlantic, and is about as well and no better supported by real observation, than the other popular error, that the valley of Ohio was warmer in winter than it was on like latitudes on the Atlantic coast. The tables in this article will place the latter theory on its proper basis. In the article SCOTLAND, there are both observation and induction, rationally speaking, to place the alleged meteorological revolution of western Europe in its true light. "There seems to be little doubt that the climate of Scotland was considerably MILDER in ancient times, than it is at present (1825); and indeed this appears too true of all the WESTERN KINGDOMS OF EUROPE."

The present winter, 1831–32, has afforded meteorological phenomena of incalculable importance on this subject. To place the early and severe cold of this winter on record, and enable the reader to compare the results with his own or the observations of others, we insert the following comparative table; premising that two of the observers are professional men, Drs. Howard and Palmer, therefore could not be expected to have it in their power to record regularly, as a person who made meteorological observations part of his business. Mr. Edward Stabler is an intelligent farmer, who merely placed the extremes on record. The four thermometers yield, by taking the days when an observation was made by each, which was the case on 34 days between Nov. 23d and Dec. 31st inclusive; Dr. Howard's* 17°; Dr. Palmer's* 17.35°; Edward Stabler's 17.1°, and William Darby's 17.09°.

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* See this Encyclopædia, Vol. XVI. pages 738—747.

TABLE XXXVI.

Comparative temperature in the vicinity of Sandy Spring, as observed with four separate thermometers.

	Dr. Henry Howard, Brookeville.				William Darby, White Cottage.				Ed. Stabler. Extreme cold.	Dr. William Palmer.
1831.	Morn.	Noon.	Evening.	Mean.	Morning.	Noon.	Evening.	Mean.		
Nov. 1	42	49	42	44.33	41	47	40	42.66		
2	33	53	46	44.	33	51	45	43.		
3	43	51	36	43.66	34	49	39	40.66		
4	30	53	39	40.66	28.5	53	37	39.5		
5	31	57	36	41.33	30	54	35	39.66		
6	30	54	40	41.33	28	50	40	39.33		
7	34	57	45	45.33	31	64	44	46.33		
8	35	52	38	41.66	36.5	54	38	42.83		
9	50	58	44	50.66	48	54	41.5	47.83		
10	46	65	60	57.00	47.5	62	59	56.06		
11	58	62	48	46.	56.5	58	47	53.83		
12	40	50	38	40.	38	49	39	42.		
13	39	51	37	42.33	37	50	40	42.33		
14	42	50	44	45.33	40	48	41	43.		
15	38	50	36	41.33	38	48	38	41.33		
16	32	48	36	38.66	32	48	36	38.66		
17	28	56	44	42.66	28	47.5	40	38.5		
18	47	49	45	47.	46	47	46.5	46.5		
19	42	48	30	40.	40.5	45	33	39.5		
20	23	48	30	33.66	23	47	33	34.33		30
21	24	54	32	36.66	23.5	52	33	36.16		31
22	32	35	30	32.33	30.5	32	29	30.5		32
23	26	38	21	28.33	25	34	27	28.66	26	28
24	25	40	29	31.33	26.5	36	29	30.5	31	30
25	19	41	26	28.66	23	36.5	27	28.83	23	23
26	32	36	35	34.33	30	36	35	33.66		32
27	36	44	38	39.33	34	40	36	36.66		36
28	30	34	23	29.	28	31	28	29.	30	29
29	20	26	21	22.33	20	24	20	21.33	22	21
30	16½	31	26	24.5	16	28	27	23.66	16½	17
Dec. 1	29	31	17	25.66	28	27	16.5	23.83	26	
2	11	37	26	24.66	10.5	34	25	23.16	10	2
3	22	38	30	30.	18	33	29	26.66	18½	21
4	24	29	14	22.3	24	25	14	21.		25
5	11	24	16	17.	10	24	16	16.66	9	10
6	11	25	16	17.33	12	23.5	16.5	17.33	11½	12
7	16	26	16	19.33	14	19.5	17.5	17.	13	14
8	11	30	21	20.66	11	28	19	19.33	12½	10½
9	26	34	24	28.	24	30	24	26.	24	25
10	22	34	18	24.66	20	30	18	22.66	20	21
11	10	36	15	20.33	10	32	18	20.	11½	13
12	20	23	04	15.66	20	20	10	16.66	16	19
13	19	30	08	19.	18	26	13	19.		14
14	18	27	25	23.33	16	22	18	18.66	15	15
15	13	20	— 5	9.33	14	16	— 2	9.33	14	12½
16	—12	23	16	9.	—13	22	20	9.66	—12	
17	20	20	8	16.	23	16	7	15.33	23	23
18	1	16	14	10.33	+ .75	12	13	8.58	1	+ 0½
19	18	36	24	26.	15.5	30	22	22.5	16½	15
20	13	28	20	20.33	13	26	23	20.66	14	13
21	12	46	29	29.	16	42	28	28.66	17½	15
22	17	22	12	17.	16	20	8	14.66	17	15
23	1	26	25	17.33	— .75	27	27	17.75	— ½	— 4
24	29	42	36	35.66	27	40	32	33.	26	27

TABLE XXXVI. continued.

	Dr. Henry Howard, Brookeville.				William Darby, White Cottage.				Ed. Stabler. Extreme. cold.	Dr. William Palmer.
1831.	Morn.	Noon.	Evening.	Mean.	Morn.	Noon.	Evening.	Mean.		
Dec. 25	26	36	28	30.	26	30	26	27.33	27	26
26	24	37	22	27.66	23	30	23	23.33	23	23
27	14	32	25	23.66	15.5	28	24.5	22.66	18	16
28	28	40	28	32.	24.5	32	27	27.83	25	26
29	28	32	20	26.66	25	28	19	24	26	27
30	18	30	23	23.66	16	24	22	20.66	16½	16
31	24	38	32	31.33	23	32	32	29	22	26
1832.										
Jan. 1	22	34	24	26.66	33.5	31.75	24	26.41	24	
2	12	36	26	24.83	15	31	25	23.66	16	
3	33	33	16	27.33	32	31.5	18	27.16	31	
4	1	31	26	19.33	0.25	28.5	25	17.92	4	
Mean.	25.8	38.72	27.67	30.73	24.05	35.95	27.69	28.26		

Summary.—Combined mean by adding together Howard's and Darby's observations, Morn. 24.92°
Noon, 37.33
Even. 27.68
Night temp. by adding those of morning and evening, mean of - - - - - - 26.3

Thus in a period of 65 consecutive days, commencing with the first of November, the mean of the warmest time of the day was only 37.33°; and the mean of the two extremes of morning and evening 26⅓° very nearly. During the same period the mercury for several days ranged near, and once fell, at the lowest, 13° below zero.

Taking the whole of the thermometrical tables into view, we find the climate of the United States liable to the extremes of 108° above, and 38° below zero. Commencing with the Atlantic coast, and advancing into the great central plains of the continent, the extremes increase in a greater ratio than would be produced by an increase in height; an effect produced no doubt by an immense open surface, exposed in summer to intense radiation, and in winter to prevalent western winds from the frozen regions along, and on both sides of a continuous chain of mountains. By table 32, we discover, that near the Atlantic coast, and as low as 39° N. there are, in winter, in ordinary seasons, 90 days on which the thermometer ranges below the freezing of water, and it is a fair inference that few winters occur on which there will not also occur sixty consecutive days during which the mean temperature will not be below the freezing of water.

The head of Climate has extended beyond the expectations of the writer, and therefore the insertion is precluded of some valuable documents supplied by Dr Wm. Palmer, on the foliage and inflorescence of indigenous forest trees. We may merely state, that from these documents and our own observation, there is frequently not much short of a month between the opening of spring in two succeeding years. The ripening of fruit and the fall of the leaf, though not liable to so great a difference in time, are, however, phenomena, which have really no fixed day.

Every season, indeed every day of the year is liable to present features very distinct from like seasons, or days, of other years. If any months could be chosen, which differ most from each other, these would be March and December. The following notes made at Sandy Spring will place this in a strong light.

March 1829.—It will be observed that the surface of the earth in this vicinity was not clear of lying snow until the 27th of this month; and at its close indications of vegetation were very slight, and confined to the grasses.

March 1830.—On the 20th, peach bud swelling; 26th, red maple in bloom, and weeping willow in full leaf. At the end of the month black haw, and crab apple leaf unfolding; peach flowers nearly expanded; and vegetation generally so far advanced that pasture was sufficiently abundant in the fields. Red clover had covered the ground; flower of the field, cherry tree opening; ploughing had been commenced.

March 1831.—At the end of this month, red maple in bloom; peach bloom opening; weeping willow in leaf; clover and grasses in a vigorous state of growth, though pasture still scarce; ploughing merely commenced.

December 1829.—This month presents the curious phenomenon of a mean temperature of 42½° Fahrenheit three degrees above that of the previous November. In December 1829, also much less snow or rain fell than did on the November. At the beginning of the new year, red clover was in a state of not slight vegetation.

December 1830. The mean temperature of this month was almost seven degrees lower than that of the same month 1829. The month was remarka2le for heavy, cloudy and rainy weather, and on the b2d, for severe cold. But the most peculiar phenomenon of the month was, that the highest range of the thermometer was on the morning of the last day, 58°, and in the midst of a thunder storm.

December 1831.—Commenced with 7 or 8 inches lying snow, and presented throughout, the temperature of severe winter, with an extreme 13° below zero of Fahrenheit, or 45° below the freezing of water. Sleighing was good in this vicinity during the whole month.

Rain.—Great as are the extremes of aerial temperature in the United States, there is also another class of meteorological phenomena, if possible, more irregular. The quantity of water which falls in the form of rain, hail, sleet, and snow, differs greatly in different years, but still more in the months of the same year. We present the reader with the following as the best data we possess on the rain of the United States, premising that there are more difficulties opposed to a correct result on this part of our subject, than we encounter with observations on temperature. Rain itself is far from being easily measured as it falls, and in the state of snow, the best estimates must be in great part conjectural, as snow is of such very unequal density, or, in plainer terms, the real quantity of water contained in a given depth of snow, is seldom determinable to any great degree of certainty. With these observations, we insert the tables as approaches towards a theory of the rain of the middle Atlantic states of the United States; with a comparative table of the rains of north-western Europe.

TABLE XXXVII.

Annual and monthly rain at Baltimore;—Observer, Lewis Brantz.

	1817	1818	1819	1820	1821	1822	1823	1824	Mean.
January	2.25	9	.7	2.8	3.3	1.8	5.6	2.3	2.85
February	2 8	2.0	1 9	2 2	5.4	4 8	.7	5.9	3.225
March	4 5	3.0	4.55	3.3	1.7	1.3	7.1	4.3	3.71
April	1.5	2.1	2.7	1.1	2 1	2.1	1.8	4.7	2.20
May	2 6	6.45	4.1	4.4	5 1	1.5	2.1	2.95	3.65
June	9.1	1 15	1.3	4.6	1.8	1.5	1.6	5.03	3.66
July	3.5	4.1	2.2	2 2	7.5	4.35	3.6	3.37	3.85
August	10.4	2.0	4.3	8.0	0 3	.8	4.1	4.5	4.3
September	3.3	3 2	3.0	1.5	10 7	2 25	5.8	2.94	4.45
October	1.8	3.1	.7	7.8	3.4	2.5	2 8	1.77	2 975
November	3 7	2.0	1.1	2.7	5.6	5.1	3.1	2.27	3 2
December	3 6	2 6	2.2	1.9	3.3	1.2	6.25	2.25	2.9
Amount.	48.55	32 6	28.75	40 5	50.2	29.2	44.55	42.28	39.97

TABLE XXXVIII.

Monthly and annual rains at Germantown, near Philadelphia;—Observer, Reuben Haines.

	1819	1820	1821	1822	1823	1824	1825	1826	1827	Monthly Mean.
January			.48	1.70	3.38	3.67	1.84	1.48	2 72	2.18
February		2.55	4.82	2.90	3.86	3.94	4.54	2.50	3.57	3.58
March		5.01	.57	2.20	6.87	2.63	5.40	3.54	1.42	3.07
April			3.05	2.16	1.77	4.54	.75	3.02	3.06	2.62
May		6.36	5.92	2.17	1.60	1.59	2.57	.22	2.58	2.87
June		1.88	2.60	1.44	.87	6.09	3.94	5.98	2.98	3.22
July	.74	6.50	1.84	3.89	6.12	8.80	1.68	5.87	2.90	4.25
August	3.86	3.64	.41	1.33	4.68	6.39	4.06	4.30	6.56	3.48
September	2.44	1.95	5.74	5.45	3.46	6.60	2.23	2.82	1.18	3.27
October	.94	8.94	3.24	1.24	2.02	1.53	1.70	5.38	6.57	3.50
November	1.00	3.12	4.65	5.00	2.47	2.49	1.05	2.05	5.30	3.01
December	1.46	3.25	2.84	1.25	7.37	2.11	3.60	1.47	4.09	3.05
Amount.	10.44	43.20	36.06	30.73	44.47	50.38	33.36	38.63	42.93	38.10

TABLE XXXIX.

Statement of the Rain fallen from 1810 *to* 1830, *inclusive, the first* 14 *years by the gauge of P. Legoux, of Spring Mill, the following seven years by that kept at the Pennsylvania Hospital.*

	Inches.		Inches.
1810	32.656	1821	32.182
1811	34.968	1822	29.864
1812	39.3	1823	41.815
1813	35.625	1824	38.74
1814	43.135	1825	29.57
1815	34.666	1826	35.14
1816	27.947	1827	38.50
1817	36.005	1828	37.97
1818	30.177	1829	41.85
1819	23.354	1830	45.07
1820	39.609		

Rain fallen in each month of 1830.

	Inches.		Inches.
1st month	1.63	7th month	4.07
2d "	2.06	8th "	3.87
3d "	4.115	9th "	2.93
4th "	1.815	10th "	4.31
5th "	3.75	11th "	5.85
6th "	5.99	12th "	5.18
			45.07

The whole quantity fallen for 21 years is 748.143 inches, which divided by 21 years, gives 35.626 inches as the usual average for that time.

The mean of these three tables, taking the years in which the monthly observations are complete, is 37.26 inches. Though much discrepancy is certainly visible on their faces, yet their coincidence is sufficient to determine the mean annual rains of the region they embrace, to be between 35 and 40 inches.

TABLE XL.

Abstract of the rains of north-western Europe.

	Inches.
Dublin, Ireland, mean of 13 years, -	24.64
Londonderry, Ireland, mean of seven years,	31.118
Cork, mean of 11 years, - -	38.93
Staffordshire, England, the annual rains exceed, - - - - -	36.00
Worcestershire, the annual rains fall short of, - - - - - -	30.00
Liverpool, mean of 18 years, -	34.41
Chatsworth, in Devonshire, mean of seven years, - - - - -	27.34
Kendal, in Westmoreland, -	60.00
Lyndon, Rutlandshire, mean of 45 years,	22.21
Ounelle, in Northamptonshire, mean of 14 years, - - - - -	23.00
London, mean of seven years, -	23.00
Kinfauns, in Scotland, mean of 13 years,	25.21
Glasgow, mean of 30 years, - -	29.6
Peebles, mean of 14 years, -	28.7
Dalkeith, mean of eight years, -	22.6
Dundee, average of nine years, -	22.6
Belmont, in Strathmore, mean of 10 years,	30.4
Longforgan, on the Tay, mean of 12 years,	24.5
Branxholm, in Roxburghshire, mean of five years, - - - - -	31.3
Mount Stewart, in Bute, mean of seven years, - - - - -	46.6
Carbeth, Stirlingshire, mean of eight years,	42.93
Mean of the 21 examples in this table,	31.2+

Placing equal confidence in the American and European tables, a result comes out, which will no doubt surprise many readers; that is, that more rain falls annually on the former, than on the latter part of the earth. If we examine the different places named in table 57, we find that along the eastern coasts of Ireland and Britain, not more than two thirds as much moisture falls in the form of rain, as does on the United States, in a given time.

We now reach the far most important difference between the climate of the United States and north-western Europe, the distribution of moisture. If the reader will refer to the articles England and Scotland, he will discover, that in many places, on both countries, days of rain and snow very nearly equal those of fair weather; and under the article Scotland it is expressly stated, that "among the fair days are included, those that are gloomy and foggy, and among the rainy days, those that were showery."

On every comparison we are able to make, the number of days in a great majority of years in the United States, are completely fair; that is, pass without any falling meteor which can come under any other denomination except those of dew or hoar frost. The following table, formed from the summary tables in Lovell's Register, is inserted as embracing a very wide extent, and consequently, not giving a limited view.

TABLE XLI.

Relative state of the weather in the United States—mean of the months, four years.

Places of Observation.	WEATHER.				
	Fair Days.	Cloudy Days.	Rainy Days.	Snowy Days.	Prevailing.
1822.					
Fort Snelling,	18.34	3.92	5.08	3.08	Fair.
Fort Sullivan,	18.41	9.58	1.83	0.59	Fair.
Fort Howard,	12.33	9.42	5.34	3.34	Fair.
Fort Crawford,	17.50	7.58	2.66	1.16	Fair.

TABLE XLI. continued.

Places of Observation.	WEATHER.				
	Fair Days.	Cloudy Days.	Rainy Days.	Snowy Days.	Prevailng.
1822.					
Fort Wolcott,	18.00	5.17	6.17	1.08	Fair.
Council Bluffs,	21.17	4.42	3.58	1.25	Fair.
Fort Columbus,	21.17	5.33	3.33	0.59	Fair.
Fort Severn,	19.67	4.50	5.08	1.17	Fair.
Fort Johnston,	16.75	7.00	6.50	0.17	Fair.
Fort Moultrie,	21.44	2.44	6.44		Fair.
Baton Rouge,	20.16	4.08	6.16		Fair.
Cant. Clinch,	18.66	1.16	10.58		Fair.
1823.					
Fort Brady,	12.83	3.08	7.83	6.66	Fair.
Fort Sullivan,	17.75	8.75	2.50	1.41	Fair.
Fort Howard,	14.66	9.16	3.58	3.00	Fair.
Fort Wolcott,	12.50	10.50	5.83	1.58	Fair.
Council Bluffs,	22.16	6.75	1.33	0.16	Fair.
Fort Columbus,	20.00	1.91	6.83	1.66	Fair.
Fort Mifflin,	19.58	6.58	3 83	0.41	Fair.
Washington,	15.75	5.58	8.16	0.91	Fair.
Fort Johnston,	17.41	7.66	5.16	0.16	Fair.
Fort Moultrie,	23.91	2.50	3.91	0.08	Fair.
Cant. Jesup,	17.83	4.91	7.66		Fair.
Cant. Clinch,	18.33	4.66	7.41		Fair.
1824.					
Fort Brady,	13.58	3.16	7.75	6.00	Fair.
Fort Snelling,	16.33	7.25	4.91	2.00	Fair.
Fort Sullivan,	17.58	9.25	2.91	0.75	Fair.
Fort Howard,	17.00	7.00	4.66	1.83	Fair.
Fort Crawford,	16.10	7.00	5.08	1.50	Fair.
Fort Wolcott,	15.58	7.75	6.50	0.66	Fair.
Council Bluffs,	19.08	7.08	2.00	2.33	Fair.
Fort Columbus,	19.58	4.00	5.91	1.00	Fair.
Fort Mifflin,	22.83	3.66	3.58	0.41	Fair.
Washington,	17.91	5.91	6.16	0.50	Fair.
Fort Johnston,	16.50	8.41	5.50	0.08	Fair.
Fort Moultrie,	23.33	2.50	4.66		Fair.
Cant. Jesup,	18.83	3.91	7.66	0.08	Fair.
Cant. Clinch,	19.08	1.00	10.41		Fair.
1825.					
Fort Brady,	13.50	3.58	7.91	5.41	Fair.
Fort Snelling,	16.16	5.33	7.33	1.58	Fair.
Fort Sullivan,	17.91	10.00	2.00	0.50	Fair.
Fort Howard,	17.91	6.33	4.66	1.50	Fair.
Fort Wolcott,	15.16	9.25	5.25	0.75	Fair.
Council Bluffs,	16.33	7.91	4.91	1.25	Fair.
Fort Columbus,	20.91	3.00	5.83	0.66	Fair.
Washington,	18.25	6.66	5.00	0.50	Fair.
Fort Johnston,	16.75	7.33	6.25	0.08	Fair.
Cant. Jesup,	19.25	4.66	6.41	0.08	Fair.
St. Augustine,	20.66	3.91	5.83		Fair.
Cant. Brooke,	18.16	3.91	8.33		Fair.

It may be noted as not a little interesting, how very near the proportion of fair days is to that of prevailing winds in the United States. In table 41, the fair days are within an insignificant fraction of 600 in a thousand, or six-tenths. The writer of this article for a long series of years pursued the profession of surveyor, which enforced observation on the weather, and has, in fact, been exposed to the vicissitude of open air, from Canada to Louisiana and Florida, which means of experience added to recent observation of others and his own, risks the conclusion, that in the year there are from 200 to 230 or 240 days, during which, man is relieved from annoyance by falling meteor.

The direct reverse is the case, and in very nearly the same proportions, on the Atlantic coast of Europe, as far south as Portugal, if not even to the coast of Africa. But the rains on the two sides of the Atlantic Ocean present other remarkable contrasts. By combining the results of tables XXXVII., XXXVIII. and XXXIX., the mean annual rains of the United States come out about $37\frac{1}{2}$ inches; whilst in table XL. the mean annual rains on north-western Europe, are only $31\frac{2}{10}$ inches. The mean annual rains of England according to Mr. Dalton, are $31\frac{1}{3}$ inches. From the whole element it appears, therefore, that on the United States, in from about 140 to 150 days there fall two-tenths more rain than falls on north-western Europe in from at the lowest term 180, and thence to 220 days.

The preceding extremes, great as they are, do not, however, represent the entire inequality in the times of an equal quantity of rain falling on the respective continents. Summer droughts so long, so severe, and so common, from the St. Lawrence to the West Indian seas, and it is true occasional on the coast of Europe, but, seasons without them are perhaps more rare on the western, than with them on the eastern shore of the Atlantic Ocean.

In brief, the climate of north-western Europe and that of the United States is alike, in the general and special course of the winds, but from the relative position of the two continents with the Atlantic Ocean, strongly contrasted in every other phenomenon.

Deep and permanent snow is a strong feature in the climate of the United States, and uncertain as are the occurrence of meteorological changes, none other differ so much as does snow. Some winters pass with slight snow; indeed there are years in which almost none of that meteor of any consequence falls, whilst perhaps the ensuing year is remarkable for excessive falls of snow. Within the last three years the snow storms have mostly come from the western points, and attended with high and steady winds which drifted the meteor excessively. This latter circumstance is amongst the revolutions in the meteorology of the United States, which must increase with the destruction of the forests. The deep and drifted snows often render the roads extremely difficult to pass, and contribute most powerfully to fill up and increase the masses of ice in rivers and canals. In fact rivers are frozen sooner and longer about in proportion to the excess of snow.

If the eye could be raised above, and powers of vision enlarged so much as to embrace the entire continent of North America, and the extreme southern line of snow so marked as to be easily traced, it would present, beside many partial two vast curves.

If we turn in mind to such a range of vision, and commence on the Pacific Ocean, we should find the snow line commencing about N. Lat. 40°, but inclining southwardly as we rose the great western spine of mountains, and again inclining northwardly as we passed that system into the central basin of the Mississippi. In the latter region, the extreme snow line is in fact that of the gulf of Mexico, though that meteor is rare so far south. The permanent line along which snow occurs annually, is about N. Lat. 34°, but sweeps southwardly once more round the extreme Appalachian, opens, and is withdrawn one or two degrees farther north along the Atlantic coast, than on the Mississippi basin.

On the Atlantic Slope, deep and abiding snows are not unknown, but they are not annual below the Chesapeake basin.

*Beyond the general limits we have sketched, the continent of North America presents from December to March, with very partial exceptions, one vast expanse of snow on the land, and ice on the rivers and lakes. Over these frozen regions the prevalent winds range along, or within 45 degrees of an axis which would be very nearly represented by a line drawn from Bhering's Strait to the Capes of the Carolinas.

Since the above was written the following document has been published, which we insert, as it shows the wide extent of the cold of December 1831; and proves the position we have taken, that the winters of the United States are still liable to present as great, if not greater extremes of cold than have been recorded of any previous like season.

"For the last 12 days the thermometer at Nashville, in Tennessee, has scarcely risen above the freezing point, and has usually fallen to the neighbourhood of zero about day-break. On Tuesday morning last, (the 13th) it was 1° below zero, on Wednesday morning 2° above, on Thursday morning 4° above, and about 10 o'clock P.M. 4° below zero.

This morning (16th) at sun-rise, it was 10° below zero. The snow which fell last week, continues of course on the ground."

See National Intelligencer, Jan. 3d, 1832.

See also our Table XXXVI.

The great severity of snow and frost experienced at Nashville, N. Lat. 36° 05′, extended to Opelousas in N. Lat. 30° 30′, as noticed in the National Intelligencer, January 10th, 1832.

During this season of intense cold the Ohio river was frozen and passable on the ice, and the thermometer sunk to 16 degrees below zero at Cincinnati; the Ohio river of course frozen in all its branches above, and in the main stream far below that city.

The New York canals were closed in the second week of December, and at Norridgewock in Maine, the thermometer sunk to 20 degrees below zero. The severe cold over the plains of Louisiana in the vicinity of Opelousas, is not a very rare phenomenon. The writer of this article resided many years at St. Landre, in Opelousas, and can assert that few winters pass there entirely without snow, and none without less or more hard frost. In the month of January 1813, snow fell to the depth of 11 inches at St. Landre, and was not entirely melted in eight days afterwards. Cotton, and other tender vegetables are frequently nipped by frost in Opelousas late in April.

On the 12th of December 1800, near Natchez, Fahrenheit's thermometer showed a cold of 12° above zero, as recorded by Mr. William Dunbar, in the Transactions of the American Philosophical Society, Vol. VI. p. 40.

Such quotations might, indeed, be multiplied to volumes, but we trust enough has been given to awaken the inquiring reader to an investigation of that atmosphere he breathes, and to the real character of a climate, upon a knowledge of which so much of human labour depends for a right or wrong application.

POPULATION.

It was our intention at this part of the article United States to have inserted a full analysis of the census of the United States, from the first enumeration in 1790, up to that of 1830; but from the non-completion of the returns of the latter, our purpose is completely frustrated. The following tables give an exhibit of the advance of population, however, in the aggregate, and may serve as a general view.

TABLE XLII.

Census of 1790.

State.	Free white males of sixteen years and upwards, including heads of families.	Free white males under sixteen years.	Free white females, including heads of families.	All other free persons.	Slaves.	Total number.
Maine	24,384	24,748	46,870	538		96,540
New Hampshire	36,089	34,851	70,171	630	158	141,899
Massachusetts	95,383	87,289	190,582	5,463		378,717
Rhode Island	16,033	15,811	32,845	3,469	952	69,110
Connecticut	60,527	54,492	117,562	2,801	2,759	238,141
Vermont	22,419	22,327	40,398	255	17	85,416
New York	83,700	78,122	152,320	4,654	21,324	340,120
New Jersey	45,251	41,416	83,287	2,762	11,423	184,139
Pennsylvania	110,788	106,948	206,363	6,537	3,737	434,373
Delaware	11,783	12,143	22,384	3,899	8,887	59,096
Maryland	55,915	51,339	101,395	8,043	103,036	319,728
District of Columbia						
Virginia	110,934	116,135	215,046	12,766	293,427	748,308
North Carolina	69,988	77,506	140,710	4,975	100,572	393,751
South Carolina	35,576	37,722	66,880	1,801	107,094	249,073
Georgia	13,103	14,044	25,739	398	29,264	82,548
Kentucky	15,154	17,057	28,922	114	11,830	73,077
Tennessee	6,271	10,377	15,365	361	3,417	35,791
Ohio						
Indiana						
Mississippi						
Illinois						
Louisiana						
Missouri						
Alabama						
Michigan						
Arkansas						
	813,298	802,327	1,556,839	59,466	697,897	3,929,827

RECAPITULATION.

Free white males, under sixteen years, - - - - - -	813,298
Free white males, over sixteen, - - - - - - -	802,327
Free white females, - - - - - - - - -	1,556,839
All other free persons, - - - - - - -	59,466
Slaves, - - - - - - - - -	697,897
Whole number in 1790,	3,929,827

When the census of 1790 was taken, all that immense region now occupied by Ohio, Indiana, Illinois, and Michigan, was an almost unbroken waste, and over Kentucky and Tennessee, not quite 109,000 persons existed. All beyond the Mississippi belonged to another government. The mass of inhabitants yet stood east from the Appalachian chains.

TABLE XLIII.

Census of 1800.

te.	FREE WHITE MALES.					FREE WHITE FEMALES.					All other free persons, except Indians not taxed.	Slaves.	Total number.
	Under ten years of age.	Of ten years and under sixteen.	Of sixteen and under twenty-six, including heads of families.	Of twenty-six and under forty-five, including heads of families.	Of forty-five and upwards, including heads of families.	Under ten years of age.	Of ten years and under sixteen.	Of sixteen and under twenty-six, including heads of families.	Of twenty-six and under forty-five, including heads of families.	Of forty-five and upwards, including heads of families.			
	27,970	12,305	12,900	15,318	8,339	26,899	11,338	13,295	14,496	8,041	818		151,719
npshire	30,594	14,881	16,379	17,589	11,715	29,871	14,193	17,153	18,381	12,142	856	8	183,762
husetts	63,646	32,498	38,305	39,729	31,316	60,920	30,674	40,491	43,833	35,381	6,452		423,245
Island	9,945	5,352	5,889	5,785	4,887	9,524	5,026	6,463	6,919	5,647	3,304	381	69,122
ticut	37,946	19,408	21,683	23,180	18,976	35,736	18,218	23,561	25,186	20,827	5,330	951	251,002
nt	29,420	12,046	13,242	16,544	8,076	28,272	11,366	12,606	15,287	7,049	557		154,465
ork	100,367	54,273	49,275	61,594	31,943	85,473	39,876	48,176	56,411	28,651	10,374	20,343	586,756
rsey	34,780	15,859	16,301	19,956	12,629	32,622	14,827	17,018	19,533	11,600	4,402	12,422	211,949
lvania	103,226	46,161	54,262	59,333	38,485	99,624	43,789	53,974	53,846	33,394	14,561	1,706	602,365
re	8,250	4,437	5,121	5,012	2,213	7,628	4,277	5,973	4,981	2,390	8,268	6,153	64,273
nd	35,852	17,392	21,234	22,778	13,394	33,796	16,437	22,367	21,170	11,906	19,587	105,635	341,548
olumbia	1,588	671	1,178	1,332	539	1,577	663	1,027	1,028	463	783	3,244	14,093
a	92,438	40,500	48,708	50,262	30,221	87,323	38,835	50,730	47,810	27,453	20,124	345,796	880,200
Carolina	63,118	27,073	31,560	31,209	18,688	59,074	25,874	32,939	30,665	17,514	7,043	133,296	478,103
Carolina	37,411	16,156	17,761	19,344	10,244	34,664	15,857	18,145	17,236	9,437	3,185	146,151	345,591
a	19,841	8,470	9,787	10,325	4,957	18,407	7,914	9,248	8,835	3,894	1,019	59,404	162,101
ky	37,274	14,045	15,705	17,699	9,233	34,949	13,433	15,524	14,934	7,075	741	40,343	220,955
see	19,227	7,194	8,282	8,352	4,125	18,450	7,042	8,554	6,992	3,491	309	13,584	105,602
	9,362	3,647	4,636	4,833	1,955	8,644	3,353	3,861	3,342	1,395	337		45,365
	854	347	466	645	262	791	280	424	393	115	163	135	4,875
ippi	1,009	356	482	780	290	953	376	352	416	165	182	3,489	8,850
na													
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	764,118	353,071	393,156	431,589	262,487	715,197	323,648	401,499	411,694	248,030	108,395	893,041	5,305,925

RECAPITULATION.

Free White Males.		*Free White Females.*		
Under ten years,	764,118	Under ten years,	715,197	
Of ten and under sixteen,	353,071	Of ten and under sixteen	323,648	
Of sixteen and under twenty-six,	393,156	Of sixteen and under twenty-six,	401,499	
Of twenty-six and under forty-five,	431,589	Of twenty-six and under forty-five,	411,694	
Of forty-five and upwards,	262,487	Of forty-five and upwards,	248,030	
	2,204,421		2,100,068	
			2,204,421	
				4,304,489
All other free persons, except Indians not taxed,				108,395
Slaves,				893,041
		Whole number in 1800,		5,305,925

In the decennial period from 1790 to 1800, the western world had begun to fill up. The western population had increased from 108,868, to 365,647; or at the rate of 335 per cent.

TABLE XLIV.

Census of 1810.

State.	FREE WHITE MALES. Under ten years of age.	FREE WHITE MALES. Of ten years and under sixteen.	FREE WHITE MALES. Of sixteen and under twenty-six, including heads of families.	FREE WHITE MALES. Of twenty-six and under forty-five, including heads of families.	FREE WHITE MALES. Of forty-five and upwards, including heads of families.	FREE WHITE FEMALES. Under ten years of age.	FREE WHITE FEMALES. Of ten years and under sixteen.	FREE WHITE FEMALES. Of sixteen and under twenty-six, including heads of families.	FREE WHITE FEMALES. Of twenty-six and under forty-five, including heads of families.	FREE WHITE FEMALES. Of forty-five and upwards, including heads of families.	All other free persons, except Indians not taxed.	Slaves.
Maine	41,273	18,463	20,403	22,079	13,291	39,131	17,827	21,290	21,464	12,515	969	
N. Hampshire	34,084	17,840	18,865	20,531	14,462	32,313	17,259	20,792	22,040	15,204	970	
Massachusetts	68,930	34,964	45,018	45,854	34,976	66,881	33,191	46,366	49,229	39,894	6,737	
Rhode Island	10,735	5,554	7,250	6,765	5,539	10,555	5,389	7,520	7,635	6,372	3,609	108
Connecticut	37,812	20,498	23,880	23,699	20,484	35,913	18,931	25,073	26,293	22,696	6,453	310
Vermont	38,062	18,347	19,678	20,441	13,053	36,613	17,339	21,181	20,792	11,457	750	
New York	165,933	73,702	85,779	94,882	53,985	157,945	68,811	85,139	85,805	46,718	25,333	15,017
New Jersey	37,814	18,914	21,231	21,394	16,004	36,065	17,787	21,184	21,359	15,109	7,843	10,851
Pennsylvania	138,464	62,505	74,203	74,193	52,100	131,769	60,943	75,960	70,826	45,840	22,492	795
Delaware	9,632	4,480	5,150	5,866	2,878	9,041	4,370	5,541	5,527	2,876	13,136	4,177
Maryland	38,613	18,489	22,688	25,255	15,165	36,137	17,833	23,875	22,908	14,154	33,927	111,502
D. of Columbia	2,479	1,158	1,520	2,107	866	2,538	1,192	1,653	1,734	832	2,549	5,395
Virginia	97,777	42,919	51,473	52,567	35,302	90,715	42,207	54,899	51,163	32,512	30,570	392,518
North Carolina	68,036	30,321	34,630	34,456	21,189	65,421	30,053	37,933	33,944	20,427	10,266	168,824
South Carolina	39,669	17,193	20,933	20,488	11,304	37,497	16,629	20,583	18,974	10,926	4,554	196,365
Georgia	28,002	11,951	14,085	14,372	7,435	26,283	11,237	13,461	12,350	6,238	1,801	105,218
Kentucky	65,134	26,804	29,772	29,553	17,542	60,776	25,743	29,511	25,920	13,482	1,713	80,561
Tennessee	44,494	17,170	19,486	19,957	10,656	41,810	16,329	19,864	17,624	8,485	1,317	44,535
Ohio	46,623	18,119	20,189	22,761	11,965	44,192	16,869	19,990	19,436	8,717	1,899	
Indiana	4,923	1,922	2,284	2,316	1,125	4,555	1,863	2,228	1,880	794	393	237
Mississippi	4,217	1,637	2,692	3,160	1,144	4,015	1,544	2,187	1,753	675	240	17,088
Illinois	2,266	945	1,274	1,339	556	2,019	791	1,053	894	364	613	168
Louisiana	5,848	2,491	2,963	5,130	2,508	5,384	2,588	2,874	3,026	1,499	7,585	34,660
Missouri	3,438	1,345	1,568	2,069	967	3,213	1,265	1,431	1,369	562	607	3,011
Alabama												
Michigan	800	351	583	763	340	640	332	368	311	130	120	24
Arkansas												
	1,035,058	468,083	547,597	571,997	364,836	981,421	448,322	561,956	544,256	338,478	186,446	1,191,364

RECAPITULATION.

Free White Males.		*Free White Females.*		
Under ten years,	1,035,058	Under ten years,	981,421	
Of ten and under sixteen,	468,083	Of ten and under sixteen,	448,322	
Of sixteen and under twenty-six,	547,597	Of sixteen and under twenty-six,	561,956	
Of twenty-six and under forty-five,	571,997	Of twenty-six and under forty-five,	544,256	
Of forty-five and upwards,	364,836	Of forty-five and upwards,	338,478	
	2,987,571		2,874,433	
			2,987,571	
				5,862,004
All other free persons, except Indians not taxed,				186,446
Slaves,				1,191,364
			Whole number in 1810,	7,239,814

In the decennial period from 1800 to 1810, Louisiana, or what now comprises Missouri, Arkansas, Louisiana and the wide Western Territory, was

central population had not quite so rapid an increase as during the preceding years. From 1800 to 1810, the western population increased from

TABLE XLV.

Census of 1820.

State or Territory.	FREE WHITE MALES.						FREE WHITE FEMALES.				
	Under ten years of age.	Of ten years and under sixteen.	Between sixteen and eighteen.	Of sixteen and under twenty-six, including heads of families.	Of twenty-six and under forty-five, including heads of families.	Of forty-five and upwards, including heads of families.	Under ten years of age.	Of ten and under sixteen.	Of sixteen and under twenty-six, including heads of families.	Of twenty-six and under forty-five, including heads of families.	Of forty-five and upwards, including heads of families.
Maine	49,217	24,528	7,146	28,530	27,742	19,178	46,565	23,982	30,823	28,248	18,527
N. Hampshire	35,466	19,672	5,529	22,703	22,956	18,413	34,599	18,899	24,806	25,797	19,925
Massachusetts	70,993	38,573	10,912	49,506	54,414	38,668	69,260	38,308	52,805	57,721	46,171
Rhode Island	11,530	5,860	1,767	7,596	7,618	5,888	10,917	5,769	8,407	8,671	7,157
Connecticut	36,848	20,682	6,284	25,731	25,632	21,814	35,289	19,833	27,205	29,069	25,078
Vermont	35,708	19,241	5,860	24,137	22,035	16,189	35,327	18,577	24,713	23,683	15,236
New York	222,608	104,297	29,598	132,733	138,634	81,259	216,513	101,904	132,492	129,899	72,385
New Jersey	42,055	19,970	5,956	24,639	24,418	18,537	39,921	19,504	25,637	24,693	18,035
Pennsylvania	175,381	77,050	25,901	102,550	97,144	64,493	166,710	78,425	101,404	94,345	59,592
Delaware	9,071	4,448	1,719	5,516	5,607	3,263	8,657	4,311	5,573	5,537	3,299
Maryland	41,511	18,952	6,261	26,404	27,916	16,960	39,454	19,578	27,293	26,347	15,807
D. of Columbia	3,276	1,540	550	2,171	2,893	1,291	3,319	1,640	2,518	2,615	1,351
Virginia	103,963	45,762	13,148	58,863	57,898	38,245	98,485	45,766	62,411	55,995	35,686
N. Carolina	75,488	32,912	9,748	39,527	36,264	25,453	70,998	33,101	42,253	38,069	25,135
S. Carolina	42,658	18,258	5,877	23,984	22,115	13,919	39,891	18,741	23,662	20,939	13,273
Georgia	35,444	14,743	4,215	19,483	17,874	10,860	33,177	14,937	18,642	15,365	9,041
Kentucky	83,050	36,004	10,383	41,328	38,178	25,136	77,641	35,120	41,905	35,483	20,799
Tennessee	67,746	28,497	7,472	31,028	27,549	18,780	63,419	27,770	31,569	27,931	15,638
Ohio	111,683	45,858	12,607	57,008	54,432	31,626	106,036	44,106	53,327	48,797	23,689
Indiana	29,629	11,454	3,270	14,428	14,072	7,066	27,684	10,707	13,635	12,009	5,074
Mississippi	8,104	3,216	1,052	4,560	5,110	2,296	7,220	3,176	3,791	3,107	1,596
Illinois	10,554	4,227	1,313	6,224	5,755	2,641	9,558	4,018	4,842	4,166	1,803
Louisiana	11,817	4,710	2,105	8,747	11,236	4,822	11,062	5,484	6,708	5,695	3,102
Missouri	10,677	4,256	1,301	6,537	6,622	2,909	9,766	3,978	5,076	4,265	1,902
Alabama	17,103	6,281	1,750	9,336	9,055	4,064	15,810	6,289	7,993	6,625	2,895
Michigan	1,220	559	152	1,334	1,661	609	1,130	525	692	595	266
Arkansas	2,420	985	329	1,427	1,453	686	2,142	927	1,179	934	426
	1,345,220	612,535	182,205	776,030	766,283	495,065	1,280,570	605,375	781,371	736,600	462,888

TABLE XLVI.

Census of 1820, *continued.*

State or Territory.	MALE SLAVES.				FEMALE SLAVES.				
	Under fourteen.	Of fourteen and under twenty-six.	Of twenty-six and under forty-five.	Of forty-five and upwards.	Under fourteen.	Of fourteen and under twenty-six.	Of twenty-six and under forty-five.	Of forty-five and upwards.	
Maine									
New Hampshire									
Massachusetts									
Rhode Island	2	1	1	14	2	3	3	22	
Connecticut			13	24			13	47	
Vermont									
New York	1,861	1,624	932	671	1,544	1,579	1,065	812	
New Jersey	860	1,583	917	628	592	1,285	1,036	656	
Pennsylvania	1	1	18	65	3	2	36	85	
Delaware	1,244	839	337	135	979	611	233	131	
Maryland	24,736	14,846	10,718	6,073	22,740	13,403	9,362	5,520	
District of Columbia	1,245	775	671	316	1,311	990	696	373	
Virginia	96,881	52,791	45,438	23,164	92,468	51,972	40,691	21,748	
North Carolina	48,914	27,511	19,395	10,731	45,055	25,663	18,326	9,422	
South Carolina	51,738	32,324	31,641	14,769	49,694	33,991	30,461	13,857	
Georgia	33,204	19,541	16,249	6,922	32,141	19,879	15,631	6,089	
Kentucky	31,469	17,132	10,944	4.369	29,231	17,407	11,801	4,379	
Tennessee	20,314	10,078	6,529	2,826	19,251	11,153	7,192	2,764	
Ohio									
Indiana	43	37	11	7	40	21	21	10	
Mississippi	7,016	4,600	4,061	1,173	6,677	4,807	3,506	974	
Illinois	170	179	133	66	139	128	71	31	
Louisiana	11,675	10,876	10,520	3,495	10,763	11,672	7,758	2,305	
Missouri	2,491	1,511	852	487	2,281	1,461	855	284	
Alabama	9,665	6,563	4,200	1,352	9,140	6,141	3,779	1,039	
Michigan									
Arkansas	323	276	143	78	293	268	157	79	
	343,852	203,088	163,723	77,365	324,344	202,336	152,693	70,637	

TABLE XLVII.

Census of 1820, *continued.*

State or Territory.	Free Coloured Persons—Males.				Free Coloured Persons—Females.				
	Under fourteen.	Of fourteen and under twenty-six.	Of twenty-six and under forty-five.	Of forty-five and upwards.	Under fourteen.	Of fourteen and under twenty-six.	Of twenty-six and under forty-five.	Of forty-five and upwards.	All other free persons, except Indians not taxed.
Maine	170	86	91	90	168	115	126	83	66
New Hampshire	97	101	85	89	109	99	106	100	139
Massachusetts	1,085	680	896	647	969	778	904	781	128
Rhode Island	577	388	343	279	550	523	465	429	44
Connecticut	1,432	911	865	629	1,421	961	950	675	100
Vermont	152	113	93	80	170	125	97	73	15
New York	5,197	3,011	3,347	1,903	5,342	4,195	4,126	2,158	701
New Jersey	3,328	1,116	1,090	882	3,093	1,198	987	766	149
Pennsylvania	5,666	3,348	3,890	1,900	5,465	4,063	4,073	1,797	1,951
Delaware	2,812	1,317	1,207	1,143	2,742	1,379	1,307	1,051	

TABLE XLVII. continued.

State or Territory.	Free Coloured Persons—Males.				Free Coloured Persons—Females.				
	Under fourteen.	Of fourteen and under twenty-six.	Of twenty-six and under forty-five.	Of forty-five and upwards.	Under fourteen.	Of fourteen and under twenty-six.	Of twenty-six and under forty-five.	Of forty-five and upwards.	All other free persons, except Indians not taxed.
Maryland	7,829	3,593	3,755	3,568	7,857	4,461	4,752	3,914	
District of Columbia	756	338	349	288	828	549	548	392	
Virginia	8,145	3,884	3,135	2,685	7,640	4,545	3,772	3,083	250
North Carolina	3,415	1,728	1,109	1,143	3,129	1,737	1,345	1,006	
South Carolina	1,376	732	647	541	1,223	836	800	671	
Georgia	330	195	180	146	349	209	195	159	4
Kentucky	585	281	284	343	468	254	244	280	182
Tennessee	700	323	240	238	532	297	224	173	52
Ohio	1,057	544	538	315	994	549	466	260	139
Indiana	275	146	141	92	251	137	120	68	
Mississippi	87	62	52	38	84	52	44	39	
Illinois	86	71	55	25	104	50	44	22	49
Louisiana	2,248	876	915	470	2,209	1,557	1,377	824	484
Missouri	93	40	36	17	62	39	34	26	29
Alabama	118	83	68	49	91	69	58	35	
Michigan	35	32	27	11	20	20	16	13	131
Arkansas	18	13	11	2	8	3	1	3	18
	47,659	24,012	23,450	17,613	45,898	28,850	27,181	18,861	4,632

RECAPITULATION.

Free White Males.		*Free White Females.*		
Under ten years,	1,345,220	Under ten years,	1,280,570	
Of ten and under sixteen,	612,535	Of ten and under sixteen	605,375	
Of sixteen and under twenty-six,	776,030	Of sixteen and under twenty-six,	781,371	
Of twenty-six and under forty-five,	766,283	Of twenty-six and under forty-five,	736,600	
Of forty-five and upwards,	495,065	Of forty-five and upwards,	462,888	
	3,995,133		3,866,804	
			3,995,133	
				7,861,937
All other Free Persons, except Indians not taxed. - - - - - - - -				4,632
Free Coloured Males.		*Free Coloured Females.*		
Under fourteen years,	47,659	Under fourteen years,	45,898	
Of fourteen and under twenty-six,	24,012	Of fourteen and under twenty-six,	28,850	
Of twenty-six and under forty-five,	23,450	Of twenty-six and under forty-five,	27,181	
Of forty-five and upwards,	17,613	Of forty-five and upwards,	18,861	
	112,734		120,790	
			112,734	
				233,524
Male Slaves.		*Female Slaves.*		
Under fourteen years,	343,852	Under fourteen years,	324,344	
Of fourteen and under twenty-six,	203,088	Of fourteen and under twenty-six,	202,336	
Of twenty-six and under forty-five,	163,723	Of twenty-six and under forty-five,	152,693	
Of forty-five and upwards,	77,365	Of forty-five and upwards,	70,637	
	788,028		750,010	
			788,028	
				1,538,038
		Whole number in 1820,		9,638,131

Free white males between sixteen and eighteen years of age,	182,205
Foreigners not naturalized, - - - - - - -	53,687

TABLE XLVIII.

Summary from 1790 *to* 1830 *inclusive.*

FROM THE NEW YORK COURIER AND ENQUIRER.

In consequence of the various enquiries relative to the new Census, we have procured from Washington, through the polite attention of Wm. C. H. Waddell, Esq. of the State Department, the following valuable document on this subject:

AN ABSTRACT of a "careful revision of the enumeration of the United States for the years 1790, 1800, 1810, and 1820," compiled at the Department of State, agreeably to law; and *an Abstract* from the aggregate returns of the several Marshals of the United States, of the "Fifth Census"—(1830).

STATE.	1790.	1800.	1810.	1820.	1830.
Maine	96,540	151,719	228,705	293,335	399,462
N. Hampshire	141,899	183,762	214,360	244,161	269,533
Massachusetts	378,717	423,045	472,040	523,287	610,014
Rhode Island	69,110	69,122	77,031	83,059	97,210
Connecticut	233,141	251,002	262,042	275,202	297,711
Vermont	85,416	154,465	217,713	235,764	280,679
New York	340,120	586,756	959,049	1372,812	1913,508
New Jersey	184,139	211,949	245 555	277,575	320,779
Pennsylvania	434,373	602,365	810,091	1049,458	1347,672
Delaware	59,096	64,273	72,674	72,749	76,739
Maryland	319,728	341,548	300,546	407,350	446,913
D. Columbia		14,096	24,023	33,039	39,858
Virginia	748,308	880,200	974,622	1065,379	1211,266
N. Carolina	393,751	478,109	555,500	638,829	738,470
S. Carolina	249,073	345,591	415,115	502,741	581,458
Georgia	82,548	162,101	252,43	340,937	516,567
Kentucky	73,077	220,955	406,511	564,317	688,844
Tennessee	35,791	105,602	261,727	422,813	684,822
Ohio		45,365	230,760	581,434	937,679
Indiana		4,875	24,520	147,178	341,582
Mississippi		8,850	40,352	75,448	136,806
Illinois			12,282	55,211	157,575
Louisiana			76,556	153,407	215,791
Missouri			20,845	66,536	140,084
Alabama				127,902	309,206
Michigan			4,762	8,896	31,128
Arkansas				10,273	30,383
Florida					34,725
	3929,827	5305,941	7239,814	9638,191	12856,464

INCREASE FROM 1820 TO 1830.

Maine	33,898 per ct.	S. Carolina	15,657 per ct.
N. Hampshire	10,391	Georgia	51,472
Massachusetts	16,575	Kentucky	22,066
Rhode Island	17,157	Tennessee	62,044
Connecticut	8,161	Ohio	61,098
Vermont	19,005	Indiaua	132,087
New York	39,386	Mississippi	81,032
New Jersey	15,564	Illinois	185,406
Pennsylvania	28,416	Louisiana	40,665
Delaware	5,487	Missouri	110,380
Maryland	9,712	Alabama	141,574
D. Columbia	20,639	Michigan	250,001
Virginia	13,069	Arkansas	113,273
N. Carolina	15,592	Florida	
Average . . .			33.392.

Note.—If the Tables recapitulating the Census returns for 1830, can be procured in time, they shall be published in a supplementary sheet at the end of the volume. It is with sincere regret that the inevitable weight of so expensive a publication as the Encyclopædia compels us to forego any further delay in our advance with the publication. In expectation of procuring the full returns of the census, the article United States has been already delayed between three and four months.

HISTORY.

Under the head of America, in the first volume of this Encyclopædia, there is included a sketch of the history of the United States, to the adoption of the Federal Constitution, and the organization of a General Government pursuant to the provisions of that instrument. Incidental circumstances of some importance in the succeeding twenty-three years, are then mentioned; but, as far as this general dictionary is concerned, there is a a period of forty-three years of political history nearly untouched. To fill this long and eventful period with such an arrangement and discussion of circumstances and character as would claim the title of a regular historical essay, is alike beyond our power, or the scope of the work. A real philosophical history of the United States would, in the present political condition of the world, be a benefit conferred upon all mankind. Such a work, if made popular by fidelity of deduction and elegance of style, would be translated and read throughout the civilized world. The moral effect of such a treatise would be as incalculably great as were the Principia of Newton on the Natural Sciences. Nor would a history of the United States, deserving the name, produce more general or salutary effect in any other part of the earth, than in the United States.

We cannot justly blame a people for not reading what we ourselves acknowledge to have no existence; but we are justifiable in expressing regret at a common neglect of history, foreign and domestic. There are numerous detached works, deserving a degree of study which they have not yet received. Some of those volumes are admirably calculated to teach the reader, that states and empires are not the ephemera they are too frequently thought to be; and that the United States arose from causes in operation even anterior to the first establishment of Anglo colonization on the continent of North America. As to the ordinary military chronological tables—for to the title of history they have no just pretension—the community experience little loss from a neglect of their perusal. Our school-books on the subject are chiefly engrossed by relations of battles. It is not, however, by battles won or lost that permanent national prosperity is to be secured. Promising only a cursory view, we divide our historical sketch into three heads: Diplomacy, Political Events, and Progress of Population.

Diplomacy is a term that the United States' agents were amongst the first to reconcile to common sense. Previous to the American revolution, an ambassador was generally a shrewd, polished spy in fact, clothed with a sacred name; but the United States ministers spoke and wrote the language of real business and truth, and have, with few exceptions, done credit to their respective missions. The wrapping of the most important interests of mankind in mystery, had become, previous to the American revolution, a subject of satire and direct censure. The rights of the many against the oppressions of the few, were gaining force; and a secret, strong, and increasing sentiment in favour of such a cause as that of the Anglo-American, was preparing the human mind to listen attentively and favourably to men who appeared as the missionaries of humanity, truth and reason. Another and most powerful aid to the American cause, was a jealousy of British power, a mainspring of foreign policy in France, which acted with more or less violence over all Europe; and thus prepared, the revolution was opened to a world which formed very confined opinions on the importance of the event.

The usual misconception, as regards revolutions in the political world, prevailed in the public mind of Europe on the occasion before us. The movement was at first considered a mere misunderstanding between the government and the colonies, in which the latter, too weak to resist, would be compelled to submit. But the principle of revolution existed in the mind of a people, who never had submitted, or seemed framed by nature to admit submission.*

The first agent, clothed with the powers of a foreign minister, sent to Europe from the United States, though not such in name, was Silas Deane. Among the parts of national history which deserve particular attention, is that which France has acted towards nations revolting against oppression. Without ever having drawn the sword with that object, Austria, Spain, and Great Britain, have in turn given France an opportunity of exerting her irresistible influence. The Swiss Cantons, the Dutch Republic, and the Republic of the United States, have, in the long period of upwards of five hundred years, contributed to attest and illustrate this curious operation of national rivalry. So strong, indeed, was the tendency towards the usual course of her policy, that imbecile as had been her administration for seventy years before its occurrence, France was slowly but inevitably drawn into the contest in opposition to a rival state; and the moment that prosperity beamed on the arms of the English colonies, they became the allies of France.

The first two treaties made by the United States, were, one of commerce, and the other of alliance with France, signed at Paris, on the 6th February, 1778. The negotiators on the part of the United States, were Benjamin Franklin, Silas Deane, and Arthur Lee; on the part of France, Conrad Alexander Gerard.

By the commercial treaty, a great and long contested principle in the laws of nations, that "free ships make free goods" was asserted and acknowledged. "Thus did France," says Mr. Lyman, "acquire the signal honour of having been the first power in the old world to recognise the independence of a youthful nation in the new."

This acknowledgement in favour of France deserves some qualification. With regret for his fate, and respect for his memory, it may be safely asserted, that Louis XVI. was incapable of perceiving the momentous crisis; but there was then a monarch in Europe, who fully understood the nature of the contest, and, according to Mr. Lyman's own testimony, was not only the first sovereign, but the first man of eminent rank, that entered into correspondence with an accredited agent of the United States. That monarch was Frederic II. of Prussia. The following letter† written by that prince to William Lee, as Mr. Lyman well remarks, "merits to be preserved, for the single consideration of being written in the year '77 by the great Frederick, in a confidential manner, to an authorised commissioner of this country."

"*Pottsdam, July* 2, 1777.

"The king, having received Mr. Lee's letter, dated Berlin, July first, and his complaint of the robbery that has been committed, is pleased to return him the answer, that his majesty has just ordered his minister of state to hear what he has farther to say on the subject: that for this purpose, Mr. Lee may communicate to the said minister without reserve, every thing he may wish to inform his majesty of;—who assures him by the present letter, that an inviolable secrecy shall be observed respecting the overture he may think proper to make through this channel."

"To governments, as to individuals, it is more difficult to regain than to continue on the strait road," says Pagannel, in his life of Frederic II., "and the British parliament in their dispute with the colonies furnished a proof. At this epoch, the Scotsman Bute was the secret chief in the councils of George III. Driven from the ministry by public opinion, he had the address to secure a successor devoted to his system of extending the royal prerogative. Entrenched behind this rampart, Bute, under cover, sapped the whig party, the indefatigable champions of American independence. One of the most necessary means to secure the triumph of his policy, was the entire submission of the colonies to ministerial authority."

Behold the judgment of Frederic II. himself on the English minister and his system.

"This Scotsman Bute, who governed the king and the kingdom, like those evil spirits of whom we hear much and never see, enveloped himself and his operations in profound darkness. His emissaries and creatures were the means by which he gave motion according to his will to the political machine. His system was that of the ancient tories, who maintain, that it is requisite to the happiness of England, that the king should enjoy despotic power. Imperious and harsh in his government, and paying slight regard to the choice of the means he employs, his unskilful management of affairs was even more notorious than his obstinacy.

"The English nation were thus degraded by their own sovereign, who finally had no will but that of his minister. But as if all former subterfuges and double-dealing were insufficient, Lord Bute wished to strike a still more bold and decisive blow for the establishment of that despotism he had in prospect. He engaged the king to impose arbitrary imposts on the American colonies, with a view to augment the revenue, and to secure a precedent which could be imitated in Great Britain.

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* Amongst the works which have come from the pen of a citizen of the United States, and emanated from the press of this country, there is not one more deserving of attentive perusal than "Lyman's Diplomacy," two vols 8vo. It is a wide field, but most worthy of culture throughout. The few notes which form that head of our article, are from that admirable treatise, which we recommend to the youth of our common country.

† Vide Lyman's Diplomacy, vol. i. page 140.

"The Americans, whom the English ministry had not *condescended* to corrupt, openly opposed an impost so contrary to their rights and their customs, and above all, to that liberty enjoyed by them ever since their original establishment. A wise government would have hastened to pacify these new-born troubles; but the ministry at London acted on different principles. They fomented new disputes with the colonies, in the case of some merchants to whom they had conferred the monopoly of certain East India merchandise, which they determined to force the colonies to purchase.

"The severity and violence of such proceedings succeeded to drive the colonies to open revolt; they held a congress at Philadelphia, where, renouncing the English yoke which had become insupportable, they declared themselves free and independent. From hence, behold Great Britain engaged in a ruinous war with her own colonies. But, if Lord Bute showed himself awkward in the preparation of this affair, he was still more so in its execution; and when the war commenced, France, always the rival of England, saw the troubles with pleasure. They underhandedly encouraged the spirit of revolt, and animated the Americans to sustain their rights against the despotism which George III. wished to establish, and presented in perspective the assistance which they were encouraged to expect."*

France watched attentively every step, and heard with interest every echo of the contest. The sacrifices made at the peace of 1763, were now to be redeemed, and they were redeemed, by the removal for ever of one of the bases of rival power. Under all these favourable circumstances, Benjamin Franklin made his appearance in Paris, clothed with full power to pursue to completion the negotiations commenced by Silas Deane. If all the circumstances of the times are taken in connexion with his own personal character, the appointment of Franklin to represent the colonies at Paris, was the most fortunate event in the revolutionary struggle. His fame had preceded him, and with his age and personal address, secured him an enthusiastic reception. His whole appearance inspired respect. His simple, modest and consistent manners, announced the ambassador of a republic. His name stood alone, without titles of honour; on his person appeared none of those proud decorations too often the substitute of talent or the livery of vice. But on this Ionic column the public voice ordered to be placed an inscription which is itself an abridged life of this extraordinary man:—

Eripuit cœlo fulmen, sceptrumque tyrannis.

To the profound knowledge requisite for his mission, Franklin united the insinuating graces of a man of polished life. "Thus," concludes Pagannel, "he did not alone excite admiration, he knew how to please; a decisive advantage in France."*

The negotiation was successful, however, from a far higher cause than even the power and graces of Franklin. On the 6th of February, 1778, by the signing of the two treaties with France, the Declaration of Independence on the 4th of July 1776, was consummated. The United States had now an acknowledged existence; and if British statesmen had understood the spirit of the age, they would have yielded to that course of things which it was beyond not only their power alone, but all human power to control. These remarks are made with no lingering feeling of hatred to Great Britain. No man can read Lyman's Diplomacy, and that still larger volume, the History of National Policy, without acknowledging that mere cold calculation instigated France and other states to countenance the new republic. Could the events of the next age have then been unfolded, the line of diplomacy would have centred in London.

The whole history of Europe relating to the age of the American revolution, fully sustains the fact, that the king of Prussia alone amongst the monarchs, understood the principles, and felt a sincere wish for the success of an attempt so adverse to power; yet this monarch did not take even the part that might have been expected from his sentiments. His conduct, however, was regulated by his cautious character, and left the Dutch republic to follow, or be influenced by the example of France, and rather by accident than preconcerted design, be the second European power to form a treaty with the United States.

The United States were further aided on the continent of Europe by the confidence felt by the British in their own power and influence. So long and uninterrupted had been the dependence, in particular, of Holland, as the whole Dutch republic was called, on Great Britain, that in the first part of the revolution the former was not even thought of as a power either able or willing to brave the lion. Yet in the issue, next to France, Holland gave most effective aid, and really next to France, if a profound view had been then taken, was the power most interested to see British pride humbled.

The first treaty between the United States and Holland, if a treaty it could be called, was negotiated by William Lee of Virginia, and Francis Van Berckel, a magistrate of Amsterdam, and was signed at Aix-la-Chapelle, on the 4th of September 1778. The instrument was in fact private, in every sense of the term, but it became public by an accident of war, and with other causes contributed to involve the Dutch republic in the contest with Great Britain. With this war raging, the seven distinct legislatures of the Dutch republic, did not finally ratify a treaty with the United States, until the 8th of October 1782; negotiated by John Adams, on the part of the United States, and George Van Randwyck and seven others on the part of the United Provinces of the Netherlands. This treaty was ratified by Congress on the 23d January 1783.

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* Pagannell's Frederick II. vol. ii. pages 313, 314, in the text and note.

† Ibid. pages 324, 325.

The stipulations of this second treaty, formed by the American government, did not, in its provisions, differ materially from the previous treaty with France. In his usual manner, Mr. Lyman has given the Dutch treaty as a note, and with appropriate remarks in the text;—remarks, which in this instance, open the vista which shows, in the remote distance, that the United States, still of comparatively small national importance, had, nevertheless, then begun to influence the political atmosphere of the world.

The British ministry, obstinately as they had pursued a course into which they had blindly rushed, were not altogether infatuated, and therefore were convinced, long before they acknowledged it, that the North American colonies were lost to Great Britain, and added to the nations who held British supremacy as an encroachment on the commercial and political independence of mankind.

The agents of the colonies, avowed and concealed, were introducing representations of the great commercial advantages held out by a new nation on the west side of the Atlantic. For many centuries past, and under various forms, a species of republic has bound together commercial men over the civilized world; and up to this moment, it is commerce, more than all other causes combined, which unites together distant nations. Great Britain and Spain, in an attempt respectively to secure colonial commerce as a monopoly, infringed a right common to all mankind. If, therefore, it did not flow from profound views of policy, the American agents pursued, from no matter what motive, a system most admirably adapted to forward their cause.

As early as May 1777, William Lee of Virginia was sent commissioner to the courts of Vienna and Berlin, empowered to "propose treaties of friendship and *commerce* with these powers, on the same commercial principles as were the bases of the first treaties of friendship and commerce, proposed to the courts of France and Spain by our commissioners, and approved in congress on the 17th of September 1776."

We have already shown, in part, the reception of Mr. William Lee at Berlin, and the disposition of the king of Prussia towards the revolted colonies; but no formal treaty was effected with that government, until one of amity and commerce was concluded in September 1785, negotiated on the part of the United States by Messrs. Franklin, Jefferson and Adams; and on that of Prussia by M. de Thulmeyer.

Though the first to enter into friendly correspondence with an American commissioner, the king of Prussia was the fourth in order of time, of the powers of Europe, to form positive stipulations by treaty with the new nation of the west.

There were circumstances peculiar to the first treaty between the United States and Prussia, which confer upon its history great interest. It was amongst the last political acts of two of the most remarkable men of their age, Franklin and Frederic II. Soon after its ratification, the former returned to his native country, and on the 17th of August of the following year, the latter closed his eventful life and reign. The treaty itself, "has been called," says Lyman, "a beautiful abstraction; is remarkable for the provisions it contains, though it does not appear that they have been attended with any good consequences to the parties, or have been of practical utility to the world. Blockades of every description were abolished; the flag covered the property; contrabands were exempted from confiscation, though they might be employed for the use of the captor, on payment of their full value. This, we believe, is the only treaty ever made by America, (*U. S.*) in which contrabands were not subject to confiscation; nor are we aware, that any other modern treaty contains this remarkable provision. We are probably indebted to Dr. Franklin for the article. It had long been a favourite subject with him to procure the exemption, from the evils of war, of all persons engaged in private pursuits or occupations, and to abolish privateering. He was desirous of having similar articles inserted in the treaty with England of 1783, and proposed them to Mr. Oswald.*"

The treaty of 1785, between the United States and Prussia, failed in its object, as is usual when too much is attempted, but it is a document of the highest interest, in another science much more exalted than diplomacy. It proves, that the Theory of Humanity began to assume consistence; and by reference to the works referred to in the margin, particularly Pagannel, it will be seen, that the enlightened, venerable, and humane Franklin, if he did make the proposals alluded to, made them to well inclined ears. The treaty, by its own limitations, has long ceased to operate; and its negotiators have long been numbered with the dead; but the principle remains; and is not the same principle the power which has nearly destroyed the detestable trade in slaves?

It is only the philosophy of history that is of any value; but of all branches of history there is none from which the philosophy is with so much difficulty separated from the mere policy, as that of the United States. It is this distinction which renders a good history of the United States so necessary, and so little to be expected whilst the actors remain on the scene. To ignorance of their actual situation relatively, may be attributed the rupture when it happened. Neither party, from 1765 to 1775, thought of separation; and, until gradually impelled beyond recession, nothing would probably have more effectually checked the colonists, than to have been convinced that their measures were leading to separation. On the other side, the British government overrated its own strength, and despised that of the colonies. This mistake was fatal to every plan, if any such had been formed, of conciliation before blood was shed, and to reconciliation afterwards. Separation became inevitable.

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* Lyman's Diplomacy, vol. i. page 145—48. Koch's Revolutions, vol. iii. page 10, and sequel. Pagannel's Fred. vol. ii. page 336, and sequel.

One mistake is general, and, if he is correctly quoted by Pagannel, was shared by Frederic II.; that is, that the English whigs were favourable to American independence. The truth of history instructs us, however, that if the British whigs and tories disagreed on every other topic, they most cordially united in a sentiment of horror against American independence. As political parties, one radical distinction existed between the British whigs and tories, on the colonial question. The whigs were for granting to the colonists the full fruition of all the rights of British subjects, but evidently only with a view of compelling them to remain subjects: the tories, attached to prerogative, sought only to establish their political principles of civil government in America as in the other colonies of Britain. The whigs foresaw and deplored the consequences, whilst the tories, without foresight beyond their own object, set at defiance the maxims of law and precepts of prudence. The course of events could not be turned by tory obstinacy; and three years of incalculable expenditure of blood and treasure, closed by the surrender of an entire army; and the alliance of the revolted colonies with France, brought the British ministry to offer as a boon, in 1778, what they had insolently denied in 1775.

Lord North's "Conciliatory Propositions," at the time of their appearance, marked the ignorance of their author, or authors, much more strongly than any other act of a ministry, notorious for unparalled faults. To a body rendered respectable in the eyes of the world by recent victory, emboldened by self confidence in its cause, and strengthened by foreign alliance, it was ludicrous to "grant pardons and immunities; to restore to the colonies their ancient charters, to exempt them from taxation, and not to require them to renounce their independence, till the treaty had been ratified by the king and parliament."

When such propositions were offered in the British parliament, it was no subject of wonder that "a dull melancholy silence succeeded to the speech." This same ministry, in defiance of common sense, and deaf to the cries of humanity, had provoked the colonies to revolt, and forced them in self defence to declare themselves free and independent, and now an offer of *pardon* and *immunity*, to men before injured beyond all forgiveness, was received with cold contempt.

It is but justice to Lord North to state, that from Franklin's correspondence, it appears that the king, George III., was the real author of the American revolution, and the irremovable obstacle in the way of any rational means of arresting its progress with honour and safety to the mother country. When, therefore, Lord North offered his Conciliatory Plan, in 1778, it is more than probable that he followed his real opinion; but the hour had passed, when that which the American people demanded, or rather implored, five years before, could be accepted.

Peace, the colonies could have had in 1778; but who was to restore the thousands fallen? Who was to rebuild the smoking ruins? Could time and its events reverse their order of procession? Independence! had any British minister dared to propose acceding to such a measure, he would have been dismissed from office, and perhaps his head would have been thrown at the feet of an enraged public.

"Where is the man that will dare to advise such a measure," thundered the dying Chatham, on the 7th of April 1778; and his voice from the brink of the tomb was responded by public opinion and feeling. "I rejoice," exclaimed the once terrible mouth, "that the grave has not closed upon me, that I am still alive, to lift up my voice against the dismemberment of this ancient and most noble monarchy."

One cause of the political decline, whilst in the full vigour of his powerful mind, was, that Chatham advocated the rights of the colonies, only as colonies; and nothing showed the bent of public feeling in England, in 1778, more distinctly than that the expiring Chatham contributed to defeat the first motion made in the British parliament, to acknowledge the independence of the thirteen united colonies. The motion was made by Mr. Powys, in April 1778, and went to authorise commissioners to treat with the colonies as independent. Fox, Burke, and their friends, supported the motion, which was lost without a division, but commissioners were sent "to grant pardons," and were received as any man of ordinary good sense might have foreseen.

Thus stood matters early in 1778. France, contrary to the real wishes of her statesmen or diplomatists, had contributed to place Great Britain in such a situation as to compel her to offer every thing but independence to her revolted colonies: but we are justifiable in the induction, that the colonies themselves alone wished for such a consummation as independence. France had been involved too far to recede; and involved from mere views and feelings of national rivalry, and calculations of commercial and political advantages. It may be said, indeed, without danger of incurring the charge of national partiality, that the diplomatists employed by the united colonies conducted their correspondence and negotiations with an ability and unity of plan, alike unexpected by their allies, and displeasing to their enemies. It soon became evident, that the conceptions of such men were far above the confined local and momentary views of mere colonists. The unwelcome truth was revealed to Europe, that choice of masters had no part in the object of the Americans; and as this truth was gradually developed, the hopes of France were weakened.

Yet no peace could be made with men whose wounded pride had not yet been sufficiently humbled; and the war continued with a widened range of action. That misguided ministry which had produced the war, maintained their places, and prolonged a destructive contest four more years; and it was not until the 22d of February 1782, that any effective step was taken to arrest a cruel waste of human blood. On that memorable day, General Conway made his motion to put an end to the American war. This was a trying moment; a debate followed, which was protracted until two o'clock in the morning, and lost by 193 votes to 194.

The closeness of the vote evinced a turn of the tide, and on the 27th the motion was renewed by Mr. Fox, and carried, 234 to 215; thus prostrating the North ministry. If we could smile at an event so productive of human misery, we might well smile at the following extract from Lyman:—

"The administration had suffered itself to be conquered in America; but the triumph of its adversaries at home was a tardy and faint one. The House of Commons relinquished the contest with evident reluctance. Indeed, we shall shortly see, that these votes did not at all indicate the feelings of that body on the subject of independence; and that a portion of the members still believed that the colonies would be re-annexed to the empire. Lord North was abandoned, because it was out of the question to continue the war; but this did not necessarily lead, in the minds of all, to the further immediate consequence—the acknowledgement of independence. The next cabinet, even formed as it was on the ruins of the war ministry, refused to recognise the act of July 1776: it was dissolved partly on account of this circumstance, and partly on account of the death of the Marquis of Rockingham. Mr. Fox, one of the secretaries of state, withdrew when it was ascertained that a principal condition on which it had been composed, the independence of America, was disavowed by a majority of the cabinet. It would not be, therefore, quite correct to say, that the vote of February 27th, though it settled, as far as England was concerned, the question of war, decided, in the same view, that of independence."*

We see how decidedly averse were the whigs of Great Britain to recognise an undeniable fact—the independence of the American colonies. As a kind of emanation from "The Armed Neutrality," in 1781, a proposition came from the courts of Russia and Austria, to arrange under their mediation a general peace. These proposals occupied the continental courts of Europe for some months, but whether from sound judgment or from strong feeling, they were properly rejected by Great Britain. As far as the interest of the colonies was concerned, the wreck of Poland served as a beacon.

The course of events, however, flowed on, and swept with it kings and ministers, prejudices and those who blindly sought a shore no longer in existence. The dreaded hour came, when the more dreaded truth was acknowledged: "The United States are free and independent."

"This is the first effort, recorded in history, of a proud and powerful government meeting, in recognition, revolted and aspiring colonies: and we may add, the first instance where a parent state has proposed and consented to arrange, in a solemn instrument, even after a bloody contest, the terms of a solid and sincere reparation; to create, by the simple process of a treaty, made in the usual forms, another great and independent nation; an event probably as unexpected to the European courts, as was the discovery of the continent, where that nation was founded."†

Another circumstance which gives sublimity to this part of history, was, that whilst the very courts who offered their mediation were extinguishing the lamp of one of the ancient kingdoms of Europe, another powerful nation rose to vindicate the insulted rights of mankind; and whilst Great Britain saw with apathy the partition of Poland, she found her punishment by her own dismemberment. These two mighty causes, as will appear from a review of the past, have yet produced but a minor share of their effects.

It was one of those happy positions assumed at the declaration of independence, and maintained with skill and perseverance, which saved the United States from the lures of European cabinet policy. After the declaration of independence in 1776, however much the states differed on some points of internal regulation, they were unanimously determined to make an acknowledgement of national independence, not merely a *sine qua non* of any treaty, but a basis of any negotiation with Great Britain. It was fortunate that such a principle was adopted; for every art was used by France and Great Britain to pursue their diplomacy, leaving either entirely neglected, or vaguely expressed, the fundamental reward of blood, toil, and victory. Truces, suspensions of arms, and every half-way measure were proposed, but in vain. Their wise adherence to forms, which were, in such a case, matters of substance, went so far, that the British government was compelled to renew the commission of Mr. Oswald, having, in the first instance, omitted the proper name, and used the term "*colonies.*" This was regarded, perhaps correctly, as intentional, was objected to, and, before the negotiations could be opened, the commission of the British envoy contained the emphatic appellation, "The Thirteen United States of America." This commission in fact contained the demanded acknowledgement, and all beyond was form and arrangement of minor objects; such as the fisheries, dispositions in favour of or against the American loyalists, now exiles; and the share that France, Spain, and the Dutch republic, might have in the final articles of the pending treaty or treaties.

Great Britain, exhausted by a war against the greatest part of the maritime force of the world, and dreading a too close alliance of her lost colonies with France, waved or evaded one difficulty after another; and her agents signed the provisional treaty of peace at Paris, on the 30th of November 1782. The negotiators on the part of the United

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* Lyman's Diplomacy, vol. i. page 92.

† Ibid. vol. i. page 93.

States, were, Benjamin Franklin, John Adams, John Jay, and Henry Laurens; and on the part of Great Britain, Richard Oswald. The definitive treaty, emanating from and repeating substantially the articles of the provisional treaty, was signed at Paris on the 3d of September 1783; on the part of the United States by Benjamin Franklin, John Adams, and John Jay, and on the part of Great Britain by David Hartley.

"The conduct of the American commissioners, in agreeing to the provisional articles without consulting the court of France, has never been fully explained," says Lyman.*

In formal terms, the conduct of the American commissioners, in this case, has not been, it is probable, explained; but does not the history of that age afford a full explanation? The stake at issue gained value, as the contests in the field and the cabinet proceeded, and a new nation had risen, claiming jurisdiction over more than the one fortieth part of the habitable earth. France expended much in the cause, but she expected too great a reward, and was disappointed. Spain presented, at an early hour, her claims to a large share of territory, within the bounds which the colonies considered as theirs by right of conquest and succession. France claimed the fisheries as her own. In brief, if we revert to the proper source, the human heart, we are at no loss to account for the readiness of the American commissioners to meet the advances of Great Britain, as soon as the latter had conceded national independence. The connexion between the colonies and the parent state was natural, whilst an alliance of the former with France or Spain could arise only from a combination of recent circumstances, and could not survive the momentary causes of production.

In one essential principle of this great event, all Europe was deceived. That was, the real views of the people of the United States. These views, vague it is most probable in 1775, became more clear as the struggle proceeded. We may even say that in the first instance very few persons in the United States regarded independence as the inevitable result of an appeal to arms. The whole war and its results were new to the world, though, when the local positions are taken into view in connexion with the moral and political features of the parties, few if any other series of great events ever flowed more naturally from causes to effects.

But of all the causes which operated in favour of the North American colonies in their revolutionary struggle, the opinion almost universal in Europe of their weakness, and the uncertain tenure of their confederacy, did them most service. The idea of easy victory infatuated the councils of Great Britain; and an expectation, that release from dependence on Great Britain, must be followed by dependence on France, had no small share in drawing the latter into the contest. A dissolution of the United States has not yet ceased to give day dreams to European politicians; reveries, which, unless the stream of events changes its course, will be most fearfully interrupted before another half century, by an exaction of too much power.

The war between the colonies and Great Britain closed; and a general peace again beaming over a desolated world, the new-born nation lost for a short period that importance in the eyes of the world, which it had sustained whilst the contest raged. But the young heart and limbs were sound and vigorous, though wearied by a long and arduous wrestle with a giant. The neighbouring nations of the earth were convinced by time, that a new and vigorous member was added to their family. It is not within the scope or design of this head of our article, United States, to notice in particular only those negotiations which affected the geographical limits and extent of the United States, sketching briefly those diplomatic proceedings arising from mere commercial intercourse or views.

Under the latter head, may be classed not only the treaties with Sweden towards the end of the revolutionary war, and with Prussia soon after the definitive peace with Great Britain, but also that entered into between the United States and the States General of the Dutch republic, already noticed.

We may here remark to its honour, that the United Provinces of the Netherlands, was the second state of Europe to acknowledge the independent existence of the United States of North America.

Sweden followed the United provinces of the Netherlands in order of time, in entering into amicable stipulations by treaty. On the 3d of April 1783, Benjamin Franklin on the part of the United States, and Philip de Creutz on that of Sweden, negotiated and signed at Paris a treaty of amity and commerce. This instrument was duly ratified by congress on the 29th of July 1783; of course it preceded the definitive treaty of peace with Great Britain.

The first commercial treaty with Sweden being for twelve years, expired on the 29th of July 1798. Though the relations were in most cases amicable between the nations, there existed no formal treaty between them from 1798, until 1816. In the latter year, Jonathan Russell, on the part of the United States, and counts d'Engerstroem and A. G. de Morner, on that of Sweden, signed at Stockholm a treaty of amity and commerce, which was ratified by congress the 25th of September 1818. In force for eight years, of course it expired in 1826.

The existing treaty of commerce and navigation between the United States and Sweden, was negotiated in 1827, at Stockholm, by J. J. Appleton on the part of the United States, and on the part of Sweden by Count de Wetterstedt. The latter, being for twelve years, will expire in 1839.

Prussia, at the commencement and throughout the revolutionary war, from the personal character of her monarch, held a rank amongst nations far above what, in ordinary cases, her relative physical force would have enabled her to assume. Mr Lyman has stepped a little out of his way, to tell us, that, "This monarchy sprung, to speak justly, from an entrenched camp," and we may be permitted to depart for a moment from our subject to remark, that the very same expressions would apply equally well to every nation of Europe. They have all had a military origin, but we notice the subject here, to correct a common error as regards the origin of both Russia and Prussia. These nations arose, it is true, from entrenched camps, but these camps were pitched as far back as those of even Great Britain or France. It would be just as correct to say, that the United States of North America sprung from the entrenchments raised in the revolution, as to say that Prussia or Russia rose in the respective reigns of Frederic I. or Peter I. In each of these cases, a great era in national history has been mistaken for its commencement.

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* Lyman's Diplomacy, vol. i. page 118.

In 1775, when the war of the revolution opened, we have already shown that the monarch of Prussia saw and comprehended the true nature of the dispute; but with a prudence which we ought to commend, from its perfect accordance with our own policy, he avoided all interference beyond his own opinion, which, strange as it may appear, was invariably given in favour of the British colonies. Yet, with all these private feelings, no public act of the Prussian king gave countenance to the United States, until 1785.

Spain, next to Great Britain, was the nation of Europe with whom the most perplexing subjects of negotiation arose, not only during, but subsequent to the revolutionary war. When the contest assumed a serious aspect, and still more, when an entire separation of the British North American colonies from the parent state was made a condition of peace by the colonies, Spain, like France, underrated the strength, mistook the sentiments, and expected to benefit itself from the weakness of the confederacy. From 1761, France and Spain might be virtually called one monarchy under two branches of the same family; but, by a singular fatality, the Bourbon monarchs of both nations, were negative, if not imbecile men, and of course their policy was founded on no fixed principles. The court of Spain was grasping and ambitious, whilst notoriously deficient in those talents which could give force to its claims. Under all the other circumstances of their situation, the United States derived infinitely more advantage from the alliance of France, and the rivalry between Spain and Great Britain, than could have been received if the two continental nations had been directed by men capable of bringing their disposable force into action. Spain and France were both at the time rich and powerful, but they were inert. Hatred and distrust of Great Britain, prevalent on continental Europe, constituted a passion in France and Spain; but, infatuated as was British policy in regard to the North American colonies, still Great Britain acted with an energy, which, with all her blunders, circumvented her Bourbon rivals, and prevented them from deriving that aggrandizement which they each expected to receive from the colonial struggle.

Influenced by conflicting views, Spain was slow and reluctant in receiving the advances of the United States, though aided by the good offices of France. The acting of a double part produced its natural consequence; and Great Britain returning, what she was pleased to regard aggression, by reprisal, Spain was driven to declare war in June 1779. Allied now with France in a common war with their formidable rival, the natural course, and what was generally expected from Spain, was a recognition of the independence of the United States; but the event disappointed general calculation. That their independence would be acknowledged by Spain without delay, was the expectation of the American congress, and is evident from the date of Mr Jay's commission as minister plenipotentiary to Madrid, which was made out in September 1779. Enough, however, was known of the views and claims of Spain on the territory which was to be comprised in the United States, to induce Congress to modify their instructions to the ambassador accordingly, and he was instructed to guaranty the two Floridas to Spain, on condition that the free navigation of the Mississippi should be secured to the United States.

Mr Jay, contrary to his own expectations and those of his country, was not formally received in Spain, where he arrived early in 1780. On the principles of her steady policy from the commencement of her colonization in America, the possession of Florida, indeed of Louisiana, was valueless to Spain, unless the Mississippi could be closed against foreign commerce.

From 1779, the question of southern and western boundary was of much higher importance to the United States, than was that of independence. The latter, every man of sound unprejudiced mind considered as settled. Great Britain, when independence was once conceded, regarded the boundary as of but minor moment after it quit the border of Canada; Spain, on the contrary, seized the occasion to extend her claim of limits to the Ohio, and made no concealment of her pretensions. Count d'Aranda, the Spanish ambassador in France, traced lines of demarcation on Michel's map, which left the Ohio at the mouth of the Great Kenhawa, and thence to and around the western shores of lakes Erie, Huron, Michigan, and Superior. These claims, early in 1780, were communicated by the French ministry to congress, and were "the *exclusive* navigation of the Mississippi, the possession of the Floridas, and the lands on the *left* bank of the Mississippi."*

These claims were not made to cover any ulterior object. They were the expression of a policy, which more genius, united with its actual means, could have rendered fatal to the best interests of the new confederacy; as, to its very existence, the left bank of the Mississippi was requisite. The boundaries afterwards recognised and stated in the definitive treaty between Great Britain and the United States, were pointed out by congress in 1779; and their promulgation operated to prevent Spain from following the part of France; and on the 23d of September, 1780, in an interview between Mr Jay and Count Florida Blanca, "the count said with warmth, that unless Spain could exclude all nations from the Gulf of Mexico, they might as well admit all: that the king would never relinquish that object; *that the ministry regarded it as the principal thing to be obtained by the war;* and, that obtained, he should be easy, whether Spain obtained other cessions or not. The acquisition was much more important than that of Gibraltar."*

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* Lyman's Diplomacy, vol. i. page 122.

It is in discussing the history of this section of its diplomacy, that we hear the first murmurs of domestic rivalry between the two extremes of the United States. The author of a proposal to accede to the claims of Spain, has been, we may say, idly sought for, as, if the following statement is founded on fact, and we have no rational basis of doubt, there must have existed a party willing to restrict the western boundary of the United States.

"Mr Jay was not accredited; and it was not until he had been ten months at Madrid, that he obtained a formal, serious conference on the subject of a treaty; a very remarkable circumstance, as Spain had now been engaged in the war more than two years. But no propositions were even then made by the Spanish government. In September 1781, Mr Jay submitted the following, among many other stipulations for a treaty, which we notice only on account of the extremely valuable privilege and right which it was proposed to abandon. This was done by order of congress, perhaps, as events have shown, the most disastrous, fatal proposition ever made by this country: "The United States shall relinquish to his catholic majesty, and in future forbear to use, or attempt to use, the navigation of the Mississippi, from the 31st degree of north latitude, that is, from the point where it leaves the United States, down to the ocean."†

We are now ready to exclaim, can these things have been? They were amongst the apparent inconsistencies of the times; yet the offer and refusal were natural results of the respective situation and views of the parties. To shut the Gulf of Mexico against foreign commerce, according to the open avowal of Count Florida Blanca, was, "*the principal thing to be obtained by the war.*" An exclusion of the United States only as far as the influx of Red River into the Mississippi, was too little for Spain. It would be to suppose the Spanish statesmen blind, if they had been held as regardless of the consequences of admitting willingly, a republican population to approach Louisiana, Texas, and Mexico. If the court of Madrid had been so little aware of consequences, Vergennes, the French minister, was ready to awaken them to their danger. The writer of this article brought from Louisiana, and deposited in the library of the Philosophical Society, Philadelphia, a very scarce production even in Europe; it is the Memoir of Count Vergennes, on the express subject of which we are now treating. From the strain of that memoir, there is strong reason to believe that Count Vergennes was greatly instrumental in upholding the Spanish claims. The memoir of the French minister, would seem to explain the object of the secret conferences of himself and the Spanish ambassador, Count d'Aranda, at the time of the signing of the preliminary treaty between the United States and Great Britain.‡

Had men of talents guided the governments of France and Spain at the close of the American war, a singular change of affairs would have been inevitable; that is, an alliance between the United States and Great Britain, to counteract one of conquest in America between France and Spain. As matters eventuated, the United States closed the war successfully, without having had an openly accredited agent in Spain, or having received one from that kingdom.

By the treaty of 1783, Great Britain asserted her own previous right to the sovereignty of the continent of North America, from the Atlantic ocean to the Mississippi, by inserting the latter great river as the western boundary of the new republic. Spain disputed the right of the parent state; of course, the legality of the boundary granted to the United States, and what may, indeed, excite some wonder, the claims of Spain, met powerful support in the United States, long after the revolution was consummated; and had Spain been consistent in her plans, and confined in her ambition to attainable objects, the consequences must have been serious to the United States; but, presuming too far, and consenting to no proposal offered, time advanced, and the feeble confederation was superseded by the existing form of government. Nations negotiate when too weak to enforce their pretensions by arms; and it was evident to a few, that unless prevented by the former mode, the United States would, in the end, open the free navigation of the Mississippi by the latter; and yet, in defiance of all foresight, Spain persisted.

The establishment of the federal and general government over the United States, and the opening of the French revolution, were nearly coeval events. Spain became involved in war with France in 1793; and the government of the former country saved the kingdom from conquest only by the treaty of Basle, in July 1795. By a singular coincidence of circumstances, France in this instance conquered for the United States, as well as for herself; and the long protracted negotiation between Spain and our ministers, was terminated on the 27th day of October 1795, by the treaty of San Lorenzo el Real; the negotiator, on the part of the United States, being Thomas Pinckney, and on that of Spain, Manuel Godoy, Prince of Peace.

The treaty of San Lorenzo el Real was ratified by the congress of the United States on the 3d of March 1796, and marked an important era in the history of our country. Numerous extraneous stipulations entered into this treaty, but those articles relating to boundaries were the only stipulations of primary importance. The boundaries thus formed have ceased to be national; but we quote part of two articles, as they serve to explain in some measure that intricate part of our history.

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* Lyman's Diplomacy, vol. i. page 216.

† Ibid. page 219.

‡ Ibid. pages 121—124, 248.

"Art. 2.—The southern boundary of the United States, which divides their territories from the Spanish colonies of East and West Florida, shall be designated by a line beginning on the river Mississippi, at the northernmost part of the thirty-first degree of latitude north of the equator, which from thence shall be drawn due east to the middle of the river Appalachicola, or Chattahooche, thence along the middle thereof to its junction with the Flint; thence straight to the head of St. Mary's river, and thence down the middle thereof to the Atlantic ocean."

"Art. 4.—It is likewise agreed, that the western boundary of the United States, which separates them from the Spanish colony of Louisiana, is in the middle of the channel, or bed of the river Mississippi, from the northern boundary of the said states, to the completion of the 31st degree of latitude north from the equator. And his catholic majesty has likewise agreed, that the navigation of said river, in its whole breadth from its source to the ocean, shall be free only to his subjects and the citizens of the United States, unless he should extend this privilege to the subjects of other powers by special convention."

"Art. 22.—And in consequence of the stipulations contained in the fourth article, his catholic majesty will permit the citizens of the United States, for the space of three years from this time, to deposite their merchandises and effects in the port of New Orleans, and to export them from thence without paying any other duty, than a fair price for the hire of the stores; and his majesty promises, either to continue this permission, if he finds during that time, that it is not prejudicial to the interests of Spain; or if he should not agree to continue it there, he will assign them, on another part of the banks of the Mississippi, an equivalent establishment."*

It must have been obvious to every reflecting person, on the mere reading of the treaty of San Lorenzo el Real, that, though it fixed the southern and western boundaries of the United States, the real difficulties between the two governments were rendered greatly more intricate. In a commercial point of view, the people of the United States were placed in a much worse situation than they were before its ratification. The king of Spain was now authorised by a solemn treaty to open the navigation of the Mississippi to Great Britain or any other nation; and the right of deposit at New Orleans, was made a contingency, depending on royal caprice. In fine, the acquisition of Louisiana, or the loss of their immense possessions beyond the spine of the Appalachian mountains, were presented as alternatives to the people of the United States. Nothing but embarrassment could be expected from such a treaty; and nothing but increasing vexations were its fruits. By Art. 3 it was stipulated that "Each party is to furnish a commissioner and surveyor, to meet at Natchez, within six months after ratification, to run the boundary line, make plans, keep journals, &c."

In virtue of this article, the United States appointed as commissioner on their part, Andrew Ellicott, who arrived at Natchez on the 24th of February 1797, and on the same day notified his arrival and commission to the Spanish governor by the following note:

"Sir,—It is with pleasure that I announce to you my arrival as commissioner on behalf of the United States, for carrying into effect the third article of the treaty lately concluded between the said United States and his Catholic Majesty.

"I wish to be informed when it will be convenient to your Excellency to receive my credentials.

"I am, sir, with due respect, your humble servant,

"ANDREW ELLICOTT.

"His Excellency, *Manuel Gayoso de Lemos.*"†

To this communication, a not very polite note was returned, and neither day nor place was named to receive the credentials of the United States' commissioner; who, on the 27th, addressed himself directly to the governor general of Louisiana, the Baron de Carondelet, at the city of New Orleans, and hoisted the colours of the United States at his cantonment in sight of the governor's house.

Mr. Ellicott makes the following statement, in page 44 of his Journal, and in a subjoined note observes, "The original letter has been in my hands."

"Before we encamped (at Natchez) the following intelligence was communicated to me through confidential channels. First, that in September previous to my arrival in that country, the Baron de Carondelet, in a private conversation, declared that the treaty would not be carried into effect; that he, as principal commissioner, should evade or delay, from one pretence or other, the commencement of the operations.

"Secondly, that a letter had been written, bearing date June 16th, 1796, by governor Gayoso, to a confidential friend, stating, that the treaty was not intended to be carried into effect, and that delay on their part would reduce it to a dead letter.

"And thirdly, that the country either was, or would be ceded to the republic of France!"

From the subsequent advance of the negotiations between the agents of the United States and those of Spain, the correctness of Mr. Ellicott's previous information was confirmed. Every obstacle, short of armed resistance, was opposed to the execution of the treaty. If we revert to the former intrigues at Paris, when the preliminary treaty of peace was signed between the United States and Great Britain, we were at little loss to account for the impediments intentionally placed in the way of fulfilling the conditions of the treaty of San Lorenzo el Real.

The southern boundary, along N. Lat. 31°, and thence by the rivers Chattahooche and St. Mary's, and the intermediate space, was but partially traced between 1797 and 1800; and in the latter year, Mr. Ellicott returned to Philadelphia. The United States had, however, in the mean time, gained full possession of its territory to the 31st degree of north latitude, and the right of deposit, if under the recent treaty it could be called a right, remained undisturbed until on the 2d day of October 1802, the then intendant of Louisiana suspended the privilege by proclamation. The commerce of the inhabitants on its shores, flows as naturally towards its mouth, as do the waters of the Mississippi; therefore, the suspension of the right of deposit at New Orleans, was a declaration of war with the people along the numerous streams above that city; and to place a deposit at that time at any other place on the Mississippi, would have been mockery, therefore the proclamation of Morales was an embargo on all the vast valley of the Mississippi, as far as the United States were interested. A state of irritation preceded the closing of the port of New Orleans, arising from petty vexations met with by the citizens of the United States, from the Spanish officers. Rage and menace followed. Thomas Jefferson was then president of the United States, who, fortunately for the people, saw the root of the mischief, and as far as on him depended the results, prepared to apply the remedy. That remedy was, to wrest Louisiana from European domination, and annex it to the United States.

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* Lyman's Diplomacy, vol. i. page 253.

† Ellicott's Journal, pages 41, 42.

Louisiana was an original colony of France, founded by that nation at the end of the 17th century, but ceded to Spain in 1762. The cession was made at a time when the Bourbon family had sunk in France to a depth far below its due weight in European policy, and the nation felt and regretted the losses to which it was exposed by an imbecile government. Amongst these losses none was more bitterly remembered than Louisiana. To France, in the decline of her marine, her American colonies were precarious in their tenure; but nations never reason, and the moment when a chance of regaining Louisiana offered, it was seized on with avidity. Indeed, we have already shown in this sketch, that France was secretly at the bottom of most of the diplomatic difficulties between Spain and the United States.

Long before the port of New Orleans was closed, vague reports were propagated, both in the United States and Europe, that the colony of Louisiana was to be re-ceded to France, and as subsequently developed, such was the case, in October 1800, by the treaty of St. Ildefonso.

The clause of cession stands unique in treaty stipulation. It runs thus: "His Catholic Majesty engages to retrocede to the French Republic six months after the full and entire execution of the conditions and stipulations above recited, relative to His Royal Highness the duke of Parma, the colony or province of Louisiana, with the same extent that it already has in the hands of Spain, and that it had when France possessed it, *and such as it should be, after the treaties passed subsequently between Spain and other powers.*"*

It will probably forever remain a secret, whether France really intended a recolonization of Louisiana, or merely gained the legal power over that country with ulterior views of negotiation with the United States. Whatever was, however, the motive, the peace of Amiens, signed the 27th of March 1802, left France free to announce the secret article of that of St. Ildefonso; an article which totally changed the political relations of the United States, as regarded the whole western and south-western border of the republic. To admit France to succeed Spain along the Mississippi, was an alternative to which war itself would have been almost unanimously preferred not only by the whole western inhabitants of the United States, but generally over most sections of the confederacy.

From the commencement of their struggle with Great Britain, it was fortunate for the United States that the French government and people possessed no adequate means to revive their power in America. In 1802, with all its real, and its much greater apparent power, and with a very precarious peace with Great Britain, it was beyond any exertion France could have made, to regain a solid footing in Louisiana. Grasping in reality, as was its administration at the epoch before us, it combined too much of political talent, to so far mistake their relative position. But there were advantages to be gained by pretending to re-occupy New Orleans, and those advantages were gained.

The promulgation of the actual retrocession of Louisiana from Spain to France, though suspected, produced all the effects of violent surprise in the United States. The worst fears were realised.

"The administration," says Lyman, "watched with an anxious and vigilant eye the movements in Europe and in its own neighbourhood. The people, at large, were probably little aware of the danger with which they were menaced; and though any great portion of secresy appears impossible in the operations of this government, yet the whole business was managed with remarkable caution and discretion. It is far, indeed, from being imaginary, that the executive looked forward at that period to the contingency of a war."

The government of the United States seems, however, to have gradually unfolded its own views, and to have shown that the actual purchase of all Louisiana was not the original conception. In a despatch, dated the 11th day of May 1802, from the secretary of state to the United States minister in Spain, are the following remarkable passages:

"Should the cession (from Spain to France) actually fail, and Spain retain New Orleans and the Floridas, I repeat to you the wish of the President, that every effort and address be employed to obtain the arrangement, by which the territory on the east side of the Mississippi, including New Orleans, may be ceded to the United States, and the Mississippi made a common boundary, with the common use of its navigation to them and Spain. The inducements to be held out to Spain were intimated in your original instructions on this point. I am charged by the President now to add, that you may not only receive and transmit a proposition of guarantee of her territory beyond the Mississippi, as a condition of her ceding to the United States the territory including New Orleans on this side, but in case it be necessary, may make the proposition yourself, in the forms required by our constitution."*

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* Lyman's Diplomacy, vol. i. page 368.

The contingency of the recession to France failing, was so far from taking place, that, towards the end of 1802, it was fully ascertained that active preparations were making in the ports of France to take possession. The situation of the United States became extremely embarrassing. By the ancient French province of Canada not becoming a part of the confederacy, Great Britain retained her footing to the northward, and now her inveterate rival was, to appearance, ready to recover her position on the south, and again expose the vast frontiers of the United States to their contentions; and what was little less disastrous, to their intrigues. The real danger was, nevertheless, most astonishingly magnified. France was formidable in Europe, but still more formidable were the evident obstacles to an extension of her power into America. It demanded a small share of political knowledge to have seen the flames of war through the parchment on which was written the treaty of Amiens. That treaty "consented to by France," says an elegant and sagacious writer, "to satisfy the public wish, had been on the side of England a concession to much more imperious necessity, and the result of a political situation much more disadvantageous than that of France. Nevertheless, the opposition party from whom this peace had been *conquered*, never ceased to make it the text for most virulent declamation, and to represent it as a treaty not less injurious to the honor than to the interests of Great Britain. Lord Grenville, who was at that epoch at the head of the opposition in the British parliament, at the opening of the session of 1802, declared, that this peace had been more fatal to England, than could have been the most ruinous war. He attacked the French government with peculiar severity, and depicted it as pressing with all the weight of an absolute tyranny on humiliated Europe; and followed this charge with a detailed enumeration of all the breaches of public faith; encroachments on the rights of neutrals; of all the usurpations of territory, which he could right or wrong impute to the French republic, and terminated with the manifest wish of an immediate rupture."

That rupture was inevitable from still deeper reasons given by our author; reasons which were conclusive as to Great Britain permitting France to regain Louisiana in full sovereignty and possession.

"But what was much more inquieting to Great Britain than military encroachments, was, that France, by means of her commercial relations and the resources of her industry, assimilated to herself every country over which she had planted her victorious standards. She transplanted every where her habits and her manners. The flexible and penetrating genius of the French was admirably calculated to effect this moral colonization of Europe, and every attending circumstance seemed to favour its development. Ancient barriers fell, and the natural limits were effaced. It was thus that the military roads of the Simplon, of Mount Cenis, and Mount Genevre interlaced France to Italy, and united by short and facile routes the basins of the Rhone and the Po. Other immense works united France to Belgium and the Lower Rhine: rich conquests which restored the ancient importance of Antwerp, and destined it to become again the centre of immense maritime action—an object at the same time most dangerous to Great Britain."†

Nor were British statesmen blind to their danger, and war was determined on, though Lord Hawkesbury, who negotiated the treaty of Amiens, and those who advised the measure, exerted themselves to preserve the peace.

The government of the United States seems to have, in a singular manner, at that time, misunderstood the real situation of European policy, if Mr. Lyman has quoted correctly, and we have no doubt of his accuracy in that or any other respect.

"In April and May 1803, Mr. Madison, secretary of state, sent the following confidential and important communications to Messrs Monroe and Livingston in Paris."

"If the French government, instead of friendly arrangements or views, should be found to meditate hostilities, or to have formed projects which will constrain the United States to resort to hostilities, *such communications are then to be held with the British government as will sound its dispositions, and invite its concurrence in the war.*

"Notwithstanding the just repugnance of this country to a coalition of any sort with the belligerent parties of Europe, the advantages to be derived from the co-operation of Great Britain, in a war of the United States at this period against France and her allies, are too obvious and too important to be renounced. And, notwithstanding the apparent disinclination of the British councils to a renewal of hostilities with France, it will probably yield to the various motives which will be felt, to have the United States in the scale of Britain against France, and, particularly, for the immediate purpose of defeating a project of the latter, which has evidently created much solicitude in the British government."‡

The whole document, of which the preceding forms a part, is in itself a proof how very narrowly the United States escaped an entangling alliance to obtain an object which was falling into its hands by the irresistible course of human events. So far from any unwillingness to enter on war with France early in 1803, no concession that government could make to Great Britain could avert an immediate rupture. Charles James Fox was the only eminent British statesman who raised his voice amid the tempest of passion which attended and followed the deceptive treaty of Amiens. In all the long rivalry of centuries, there was, it may be safely asserted, no other period when national hostility was more violent, and particularly on the part of Great Britain, than from the 27th of March 1802, when the treaty of Amiens was signed, to the 16th May 1803, when war was again declared against France.

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* Lyman, vol. i. page 374.

† Rabbe's Alexander I. vol. i. pages 68, 69.

‡ Lyman, vol. i. pages 376, 377.

We have already informed the reader, that an annunciation of her acquisition of Louisiana by cession from Spain, was promulgated by France immediately after the ratification of the treaty of Amiens; and we may very safely say, that without any understanding with the United States, preparations on the part of France to form an establishment at New Orleans contributed its full share to the declaration of war on the part of Great Britain.

Here again we may pause upon the reflection, how much and how salutary has been the rivalry of France and Great Britain to the United States. Sanguinary as was that rivalry, some compensations to its evils have been produced, and of those in its remote consequences, if the interests of the whole civilized world are taken into the estimate, was the union or incorporation of the vast regions of central North America with the original United States.

The union of Louisiana with the United States was foreseen by Count Vergennes, but the immediate causes were very different from those anticipated by that French statesman. The conquest of that country from Spain was held in prospect, and it is probable that a feeling that such an attempt would be made on the part of the United States, assisted to influence Spain to retrocede the whole immense territory to France. It was so retroceded, and so much was the transfer dreaded in the United States, that we have shown that the pacific councils of Jefferson and Madison, considered war with France and alliance with Great Britain as preferable alternatives; and yet, the United States stand indebted to the retrocession to France for the peaceable and comparatively cheap acquisition of Louisiana.

Involved once more in war with great Britain, and awaiting the shock of a coalition, France at once abandoned her scheme, if such a scheme was ever seriously formed, and made an overture to sell the country to the United States for a valuable consideration in money. We have already premised, that the views of the United States government expanded as circumstances developed themselves, and from an inchoate design of obtaining New Orleans and the Floridas, all Louisiana was finally purchased. It is not within the scope of this sketch to go over the negotiations which led to the great result; but we proceed to their happy termination.

The convention by which Louisiana was secured to the United States, was signed at Paris, on the 30th of April 1803; the negotiators on the part of the United States being Robert R. Livingston and James Monroe, and on the part of France, Barbé Marbois; the price, sixty millions of francs, besides a sum paid to American citizens for French spoliations on our commerce; making together a gross sum of about fifteen millions of dollars.

The actual transfer to the United States, was made at the city of New Orleans on the 20th of December 1803, when Louisiana became an inseparable part of the domains of the United States.

Except along the river Mississippi above N. Lat. 31°, and upon a part of the northern shore of the Gulf of Mexico, the boundaries of Louisiana, as ceded by France to the United States, were vague and undetermined. As held by France, previous to the first cession to Spain, the river Perdido formed the boundary between Louisiana and Florida. Spain, becoming mistress of both provinces, extended the name of Florida to the Mississippi, and under that term ceded the country to Great Britain. The latter government divided Florida into two provinces, East Florida, and West Florida; the latter extending from the river Perdido to the Mississippi, and separated from Louisiana by the Iberville and Amite rivers, and lakes Maurepas and Pontchartrain. Thus stood those respective provinces, when war between Spain and Great Britain burst forth during the American revolutionary contest. Spain, in possession of New Orleans, and other parts of Louisiana, availing herself of a favourable position, invaded and conquered West Florida, which with East Florida was formally ceded to her by the government of Great Britain in 1783.

The name of West Florida had become established, and that of Louisiana antiquated between the Mississippi and the Perdido rivers, and remained so in common language during the existence of Spanish domination. There was evidently from these historical facts, either an intentional or accidental contradiction in the article of cession from Spain to France, which to save reference we recite: "*The colony or province of Louisiana, with the same extent, that it already has in the hands of Spain, and that it had when France possessed it.*"

The United States, receiving Louisiana from France, as the latter did from Spain, claimed the Perdido as its eastern boundary; but Spain resisted that construction, and continued to hold all that was included under the relative terms East and West Florida; and of course still exercised dominion on the left bank of the Mississippi, from N. Lat. 31° near the mouth of Red river, down that stream to the outlet of Iberville river. It must be also conceded from the foregoing, that Spain had plausibility if not justice on her side. Mr Lyman enters into a long explanation of this intricate question, but we may safely pronounce that when France obtained the recession, both parties understood by Louisiana "as France possessed it," to mean that the eastern boundary was to be the Perdido, and no man who understands the history of Louisiana can doubt for a moment that if France had actually regained that province, her government would have extended its authority to the bounds of what the colony comprised previous to 1763.

The writer of this article resided in Louisiana at the time of the controversy, and heard an opinion generally expressed which he still believes correct, that had the government of the United States proceeded to take possession in 1803, of all ancient Louisiana, the subsequent idle dispute would have been avoided, and without incurring even the danger of war. As had been the case in every former instance of controversy between the United States and Spain, France leaned with all her weight in favour of the latter. The inhabitants of West Florida were divided into two unequal parties. A few who held offices, and some persons from particular reasons, sided with Spain, and its governor Folch; but the much greater number regarding themselves rightfully citizens of the United States, and well knowing that peace and tranquillity, as well as individual security, depended on their being received into the union, regretted that such had not been their lot, with other parts of ancient Louisiana. A state of irritation was the consequence, attended with violence and some bloodshed. The United States government paid more respect to the claims of Spain than was reciprocated; but the people of West Florida, at length driven to desperation, openly revolted in 1810, seized the Spanish Fort at Baton Rouge, and compelled the United States to do what ought to have been done in 1803. Orders were sent to Wm. C. C. Claiborne, governor of Louisiana, to occupy West Florida; orders which were promptly executed, and the former eastern boundary restored.

It seems, however, that the boundaries between the Anglo-American territories, and those of Hispano-America, were to remain an inexhaustible source of vexatious litigation, in the form of diplomatic controversy. France sold Louisiana, as France held that province under original discovery and original colonization. From the time that the first French colony landed on the northern coast of the Gulf of Mexico, to the treaty of 1763, the western boundary of the French province was matter of perpetual dispute between the two governments and their respective agents. France claimed to St. Bernard's Bay, where La Salle landed in 1685; Spain claimed to within nine miles of Natchitoches on Red River, at a small creek called by the Spaniards Rio Hondo. The disputed territory included a great part of the large country of Texas. The entire cession of Louisiana to Spain, silenced the contest during the 40 years from 1763 to 1803. The United States, representing France, very naturally revived the claim to the westward, and the field of negotiation on that subject was again thrown open; but the importance of the western boundary was soon lost sight of, in a discovery that whilst Spain nominally held East Florida, distraction reigned on the southern border of the United States. In all diplomatic discussions, the highest object at issue is the happiness of the people who are to be affected by interstipulations. If the lives even of millions had not been at jeopardy, we might well smile to hear the government of France charging that of the United States with proceedings "which nothing can authorise towards a power, which has long occupied, and still occupies, one of the first ranks in Europe." This was the diplomatic language of M. Talleyrand in December 1804, when France was treating the whole Spanish monarchy with far less ceremony than she would have dared to do one of her own departments. The real fact was, that from the beginning of this century, and in particular from 1808, the power of Spain had ceased as to all beneficent purposes, and existed on the continent of America for those only injurious to mankind. West Florida, and afterwards East Florida, afforded instances, which, intermingling with the history of the United States, we feel interested to trace to the abatement of the evil. We cannot however follow, step by step, negotiations, which on one side were conducted with evident design of delay. The shores and havens of Florida became the resort of every species of armament which, without national responsibility, could vex and plunder those employed in the legal pursuits of commerce. In the war between the United States and Great Britain, the whole province became a hostile flank to the former, and it is amongst the most singular instances of a departure from the *ratio ultima regum*, of which history affords us an example, that it was not permanently occupied by the military and naval force of the United States. More rational and more positively efficacious measures were adopted, and after tedious preliminary discussions and correspondence, a treaty of amity, settlement, and limits, was signed at Washington on the 22d February 1819. The negotiators were, on the part of the United States, John Quincy Adams, and on that of Spain Don Louis de Onis. Of this treaty, the parts relevant to our purpose are:

"Art. 2. His catholic majesty cedes to the United States, in full property and sovereignty, all the territories which belong to him, situated to the eastward of the Mississippi, known by the name of East and West Florida, &c."

"Art. 3. The boundary line between the two countries, west of the Mississippi, shall begin on the Gulf of Mexico, at the mouth of the Sabine, in the sea, continuing north along the western bank of that river, to the 32d degree of north latitude; thence by a line due north, to the degree of latitude where it strikes the Rio Roxo of Natchitoches, or Red River; then, following the course of the Rio Roxo westward, to the degree of longitude 100, west from London, and 23 from Washington; then crossing the said Red River, and running thence, by a line due north, to the river Arkansas; thence, following the course of the southern bank of the Arkansas, to its source, in latitude 42° North; and thence, by that parallel of latitude, to the South Sea; the whole being, as laid down on Melish's Map of the United States, published at Philadelphia, and improved to the first of January 1818. But, if the source of the Arkansas river shall be found to fall north or south of latitude 42°, then the line shall run from the said source due south or north, as the case may be, till it meets the said parallel of latitude 42°, and thence, along said parallel to the South Sea. All the islands in the Sabine, and the said Red and Arkansas rivers, throughout the course thus described, to belong to the United States; but the use of the waters, and the navigation of the Sabine to the sea, and of the said rivers Roxo and Arkansas, throughout the extent of the said boundary, on their respective banks, shall be common to the respective inhabitants of both nations."

"The two high contracting parties agree to cede and renounce all their rights, claims and pretensions, to the territories described by the said line, that is to say: the United States hereby cede to his Catholic Majesty, and renounce forever, all their rights, claims, and pretensions, to the territories lying west and south of the above described line; and, in like manner, his Catholic Majesty cedes to the said United States, all his rights, claims, and pretensions, to any territories east and north of the said line; and for himself, his heirs and successors, renounces all claim to the said territories forever.*"

Art. 4. Provides for the survey of the boundary, as designated in the preceding, by a commissioner and surveyor, who were to have been appointed by each nation, and who were "to meet before the termination of one year, from the date of the ratification of this treaty, at Natchitoches, on the Red river, and proceed to run and mark the said line, &c." But, the delays in the ratification of the treaty on the part of Spain, and other causes, have operated to prevent any steps being taken to establish any part of the immense boundary which obliquely crosses the continent of North America, and, without estimating the minute curves of rivers, amounts to at least 2300 statute miles.

When we read the treaty of Washington, we are led to infer from its phraseology, that the original draught had been made in English, and that uncommon care had been used to render the stipulations clear and perspicuous; but it appeared that no language could protect the United States from tedious delay on the part of Spain, even in cases where no assignable pretext or benefit gave excuse. Pretexts were made, however, and though in this instance Spain received no countenance from the other powers of Europe, but rather on the contrary was advised to close amicably a negotiation in which the entire civilized world was directly or indirectly concerned, yet it was not until the 24th of October 1820, that the treaty was ratified by the king of Spain; and on the 22d February 1821 the ratifications were exchanged at Washington.

If we regard it in all its bearings, the treaty of Washington with Spain, was one of the most important transactions in which the United States were ever engaged. It closed, at least for the present age, a most intricate series of negotiations of nearly 40 years duration, and extended the land border of the United States to the Gulf of Mexico. But the day must come, and is not very distant, when a most complex, and—unless more prompt than the mother country,—a most tedious negotiation will arise with Mexico. If we except a small share of this extended national border on the Sabine, every other part is liable to conflicting construction from the terms of the treaty.

We now proceed to notice the boundary of the United States on the side of the British provinces of New Brunswick and Lower Canada, by quoting the whole second article of the treaty of peace of 1783, between Great Britain and the United States, which affords a striking example of how inadequate are the terms of human language to defend against human ingenuity.

"Art 2.—And that all disputes which might arise in future, on the subject of the Boundaries of the said United States, may be *prevented*, it is hereby agreed and declared, that the following are and shall be their boundaries:—from the north-west angle of Nova Scotia, viz. that angle which is formed by a line drawn due north from the source of St. Croix river to the highlands; along the said highlands which divide those rivers that empty themselves into the river St. Lawrence from those which fall into the Atlantic Ocean, to the north-westernmost head of Connecticut river. Thence down along the middle of that river, to the forty-fifth degree of north latitude; from thence by a line due west on said latitude until it strikes the river Iroquois or Cataraquy;† thence along the middle of said river, into Lake Ontario, through the middle of said lake until it strikes the communication by water between that lake and Lake Erie; thence along the middle of said communication into Lake Erie, through the middle of said lake until it arrives at the water communication between that lake and Lake Huron; thence along the middle of said water communication into the Lake Huron; thence through the middle of said lake to the water communication between that lake and Lake Superior; thence through Lake Superior, northward of the isles Royal and Philipeaux, to the Long Lake; thence through the middle of the said Long Lake, and the water communication between it and the Lake of the Woods, to the said Lake of the Woods; thence through the said lake to the most north-western point thereof—and from thence on a due west course to the river Mississippi; thence by a line to be drawn along the middle of the said river Mississippi, until it shall intersect the northernmost part of the thirty-first degree of north latitude. South, by a line to be drawn due east from the determination of the line last mentioned, in the latitude of thirty-one degrees north of the equator, to the middle of the river Apalachicola or Catahouche; thence along the middle thereof to its junction with the Flint river; thence straight to the head of St. Mary's river; and thence down along the middle of St. Mary's river to the Atlantic

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* Lyman, vol. ii. page 136—137.

† Now St. Lawrence. From old maps and geographical sketches, it appears that the river now called Ottaway was in the early period of French colonization called St. Lawrence, whilst above the island of Montreal to Lake Ontario, the intermediate river was known under the name of Iroquois or Cataaquy.

Ocean. East, by a line to be drawn along the middle of the river St. Croix, from its mouth in the Bay of Fundy, to its source, and from its source directly north to the aforesaid highlands, which divide the rivers that fall into the Atlantic Ocean from those which fall into the river St. Lawrence: comprehending all islands within twenty leagues of any part of the shores of the United States, and lying between lines to be drawn due east from the points where the aforesaid boundaries between Nova Scotia on the one part and East Florida on the other, shall respectively touch the bay of Fundy and the Atlantic Ocean; excepting such islands as now are, or heretofore have been, within the limits of Nova Scotia."

This article, which opens with a promise of preventing disputes respecting boundaries, contains, except those parts which are palpably natural, no specified boundary which was not liable to be the ground of protracted dispute; and one of the most serious magnitude has arisen in regard to the first and last boundary comprised under its stipulations. To render the causes of this contest more intelligible to the reader, we enter into some geographical detail.

From the total silence of the treaty respecting St. John's river, we may presume, that to the framers, the fact was unknown, and of course unsuspected, that a large share of its basin comes within the scope of its provisions. By turning to our description of St. John's river in this article, the reader will discover the very remarkable fact, that its remote sources interlock with those of Chaudiere and Penobscot, and entirely overhead the latter, reaching, indeed, within eighty miles of the extreme fountains of Connecticut. From these sources, the higher volume of St. John's and the general range of its valley for about 150 miles, are very nearly parallel to the St. Lawrence; leaving an intermediate strip of land from 50 to 70 miles wide between the two rivers. What is again of the most importance, as far as the contested boundary is concerned, the much greater part of the narrow region between the upper St. John's and St. Lawrence is drained into the former. From the city of Quebec, in a N.E. by E. direction, the distance is only about 45 miles, to the basin of St. John's; and and about 125 miles lower down both streams, and opposite the influx of Saguenay, it is not 20 miles from the right bank of St. Lawrence to the sources of the extreme northern confluents of St. John's. According to Tanner's United States map, these northern fountains of St. John's, or the heads of Mattawaska, are in N. Lat. 47° 52′, and Long. 8° E. from Washington city, extending within nearly a degree of latitude north of the city of Quebec. From the preceding geographical point, the Mattawaska, and, below their junction, the St. John's, flow by comparative courses S.E. by E. 90 miles to N. Lat. 47°, and thence by a course of a little E. of S. nearly over another degree of latitude, and reaches within less than 20 miles from the source of St. Croix river.

If a line be drawn due north from the head of St. Croix river, it will gradually incline upon, reach and pass over the main volume of St. John's in a distance of about 80 miles; and thence traversing the sources of Ristigouche river, intersect the highlands, agreeably to the treaty of 1783, almost on N. Lat. 48°, and Long. 9° 10′ E. from Washington city.

Above a line drawn as designated in the preceding paragraph, the St. John's and its confluents drain a surface rather exceeding 10,000 square miles, and lying directly between the upper part of Lower Canada and New Brunswick. There can be no reasonable doubt that more correct geographical knowledge would have greatly modified the treaty of 1783, and would have probably caused the continuation of N. Lat. 45°, as designated in the treaty of Utrecht, 1713; and there are as few doubts that a fair interpretation of the treaty of 1783, would leave the whole basin of St. John's to the United States; but the political consequences to the British provinces were too serious, and hence disputes, which time and all attempts of amicable arrangement have failed to settle. It was for the purpose of having the point at issue determined, that the following provision was made by the treaty of Ghent.

"Art. 5. Whereas neither that point of the highlands lying due north from the source of the river St. Croix, and designated, in the former treaty of peace between the two powers, as the northwest angle of Nova Scotia, nor the north-westernmost head of Connecticut river, has yet been ascertained; and whereas that part of the boundary line between the dominions of the two powers which extends from the source of the river St. Croix, directly north to the above mentioned northwest angle of Nova Scotia, thence along the said highlands which divide those rivers that empty themselves into the St. Lawrence, from those which fall into the Atlantic Occean, to the northwesternmost head of Connecticut river; thence down along the middle of that river, to the forty-fifth degree of north latitude; thence by a line due west on said latitude until it strikes the river Iroquois or Cataraquy, has not yet been surveyed; it is agreed that for these several purposes, two commissioners shall be appointed, sworn and authorised to act exactly in the manner directed with respect to those mentioned in the next preceding article, unless otherwise specified in the present article."

In article 4, it was stipulated, that a board of commissioners was to be formed to adjust these disputes, and it was provided, that in case of disagreement or refusal to act, the respective commissioners "shall make jointly or separately, a report or reports, as well to the government of his Britannic majesty as to that of the United States, stating, in detail, the points on which they differ, and the grounds upon which their respective opinions have been formed, or the grounds upon which they, or either of them, have so refused, declined or omitted to act. And his Britannic majesty, and the government of the United States, hereby agree to refer the report or reports of the said commissioners to some friendly sovereign or state, to be then named for that purpose, and who shall be requested to decide on the differences which may be stated in the said report or reports, or upon the report of one commissioner, together with the grounds upon which the other commissioner shall have refused, declined or omitted to act, as the case may be. And if the commissioner so refusing, declining or omitting to act, shall also wilfully omit to state the grounds on which he has so done, in such manner as the said statement may be referred to such friendly sovereign or state, together with the report of such other commissioner, then such sovereign or state shall decide *ex parte*, upon the said report alone. And his Britannic majesty and the government of the United States engage to consider the decision of such friendly sovereign or state to be final and conclusive on all the matter so referred."

Without aid from the inductions drawn from history, the preceding extracts would seem to have provided the full means of complete adjudication in the last resort, and without appeal; but the result did more justice to history than did the provisions of the treaty of Ghent to the objects of its stipulations. Boards of commissioners were appointed, and proceeded to execute their respective duties. That under the recited 5th article advanced and fixed the head of the St. Croix river, which, as laid down by Tanner, is at 45° 57′ N. Lat. and in Long. 9° 10′ E. from Washington city. Advancing thence due north, as provided by the treaty of 1783, the line of demarcation was drawn something above forty miles to a place called Mars Hill. This hill is very nearly on the mid distance between the head of St. Croix river and St. John's river, on the due north and south line, and about ten miles westward from the nearest part of the right bank of the latter. Here the British commission arrested the farther continuation of the boundary in its northern direction, contending, that they had reached the "*Highlands which divide those rivers that empty themselves into the river St. Lawrence, from those which fall into the Atlantic Ocean.*"

If the real base of the objection to carry the letter of the treaty of 1783, had been geographical, it would have been sufficient to show that an inflected line from Mars Hill, drawn along the dividing ridge between the sources of St. John's and Penobscot rivers, must extend upwards of 150 miles before reaching a single fountain the water of which flowed into St. Lawrence; and that in a direct line Mars Hill was more than 120 miles distant from the highlands between the sources of St. John's and Penobscot, flowing into the Atlantic Ocean, and those of the Chaudiere, discharging its waters into St. Lawrence. But the true objection lay deeper, and the United States and Great Britain made choice of the king of the Netherlands to arbitrate the matter. After years of delay, the award of the king of the Netherlands was made; and, similar to an immense majority of awards, it left the litigation tenfold more embroiled, by directly violating the rights of one party, and falling far short of the claims of the other; and there remains unsettled the boundary of the United States on the north-eastern extreme, involving one-third part of the surface of the state of Maine.

From the head of Connecticut river to the Sault, or Rapids of St. Mary, the boundary between the United States and the British territories is fixed, and was finally determined under the 6th article of the treaty of Ghent, and by a report signed at Utica, the 18th of June 1822, by Peter B. Porter for the United States, and Anthony Barclay for Great Britain. From the Straits of St. Mary to the north-western, or rather the western part of the Lake of the Woods, the common boundary remains agreeably to the treaty of 1783. By that treaty, however, an impossible boundary from the Lake of the Woods to the river Mississippi was provided for, in these words, viz. "and from thence (the most north-western point of the Lake of the Woods) on a due west course to the river Mississippi."

Future discovery demonstrated what was then (1783) suspected, that the extreme northern sources of the Mississippi did not reach the latitude of the north-westernmost, or any part of the Lake of the Woods. It is not probable that the extreme sources of the Mississippi are yet determined to the utmost certainty; but sufficient has been ascertained to decide the facts, that no water flowing into the Mississippi rises as far north as 48° of N. Lat. and that the southern angle of the Lake of the Woods is at least as high as N. lat. 48° 50′.

The whole boundary or boundaries from N. lat. 45° on Connecticut river to the Rocky, Stony, or Chippewayan mountains, is or are indeed fixed on the basis of the treaty of Utrecht, in 1713. That part between the Lake of the Woods and Rocky Mountains, was finally fixed (as far as a convention could fix it), by solemn stipulation in the convention or treaty of that year:

"Art. 2.—It is agreed, that a line drawn from the most north-western point of the Lake of the Woods, along the 49th parallel of north latitude, or if the said point shall not be in the 49th parallel of north latitude, then that a line drawn from the said point, due north or south, as the case may be, until the said line shall intersect the said parallel of north latitude, and from the point of such intersection due west along and with the said parallel, shall be the line of demarcation between the territories of the United States and those of his Brittannic majesty, and that the said line shall form the northern boundary of the said territories of the United States, and the southern boundary of the territories of his Britannic majesty, from the Lake of the Woods to the Stony Mountains."

"The extreme north-western point of the Lake of the Woods, is declared to be latitude N. 49° 23′ 54″, and Long. 95° 14′ 38″ W. (18° 19′ 38″ W. from W. C.), so that in conformity with the treaty, this point having been ascertained to be north of parallel 49°, a line is drawn due south from it to parallel 49°; on which it is to be continued to the Rocky Mountains. No means have yet been taken to delineate the boundary westward from the Lake of the Woods."*

We proceed to close these diplomatic reviews of the boundaries of the United States, with a notice of an object destined to become of the most stupendous consequence; that is, the great basin of Oregon, and the adjacent regions on the Pacific Ocean, westward of the Rocky or the Chippewayan mountains.

The great river, named by the Spaniards (the original discoverers of the coast) Oregon, and by travellers and writers of the United States until recently, Columbia, pours its great volume into the Pacific at N. Lat. 46° 19′ and Long. 46° 25′ W. from W. C.

Oregano, in Spanish, is the name of wild marjoram, and without pretending to give that as the origin of the name of Oregon river, we may, however, suggest, that such was the fact, from that plant or some other bearing to it a strong resemblance, being found on its banks. Let that conjecture be well or ill founded, the revival of Oregon ought to be supported, to avoid the embarrassing repetition of the same name so common in American geography. In the present case we are more concerned with the political claim of the United States to the basin and adjacent parts, than with their geography.

It was certainly making the most of a claim, to include Oregon in Louisiana, as did many writers and speakers of eminence, subsequent to the acquisition of the latter by the United States. Nor was such questionable extension requisite. We have already shown that, by the treaty of Washington, Spain surrendered to the United States all claim to the northward of N. Lat. 42°; of course, from the final ratification of that compact, the United States obtained sovereignty over Oregon as far as Spain was concerned; but two much more powerful competitors presented themselves to disturb the title, Great Britain, extending her claims from the eastward, and Russia from the northwest coast.

It is useless to traverse a beaten path, to prove priority of discovery, as Vancouver himself acknowledges that the first knowledge he received of Columbia river was from Captain Gray, of the ship Columbia. We shall merely and briefly state that some merchants of Boston in 1788 fitted out two vessels, for the express purpose of trading to the northwest coast of North America. One of these vessels, the Columbia Redivina, was, on a second voyage, 1792, commanded by Captain Robert Gray, who discovered and entered a great river, the Oregon. Captain Vancouver was then at Nootka, and Captain Gray, naming his great discovery after his own ship, very fortunately communicated the whole to Vancouver, who sent his first lieutenant to survey the entrance, but acknowledges the facts. Again, the expedition of discovery under the direction of Lewis and Clarke, is known to every reader, and in 1804, 1805, 1806, completed the inland discovery of the central parts of the basin of that river, called by them Columbia. The British government, urging claims to the same region, succeeded in some measure to obtain a recognition of their justice from the United States in the convention of 1818.

"Art. 3. It is agreed, that any country that may be claimed by either party on the northwest coast of America, westward of the Stony Mountains, shall, together with its harbours, bays, and creeks, and the navigation of all rivers within the same, be free and open, for the term of ten years from the date of the signature of the present convention, to the vessels, citizens, and subjects, of the two powers: it being well understood, that this agreement is not to be construed to the prejudice of any claim which either of the two high contracting parties may have to any part of the said country, nor shall it be taken to affect the claims of any other power or state to any part of the said country: the only object of the high contracting parties, in that respect, being to prevent disputes and differences amongst themselves."

If we revert to the subsequent history of the far greater number of treaties entered into by the United States, the latter part of the above quoted article ought to read "the only fruit of all the foregoing, will be abundant disputes between the parties."

The progress of European discovery, claims of sovereignty, and colonization, is a new and illimitable field of political history; and far the most extraordinary feature in this greatest of all revolutions, is, that the christian nations of Europe, making professions of pre-eminent principles of justice and humanity, have actually invaded and conquered no small share of every other section of the earth. Of these gigantic invaders, the Russians have acted by far the most important part, though, from relative position, their progress in eastern Europe, northern Asia, and northwestern America, has attracted comparatively but little attention. Advancing from west to east in a reverse direction to the progress of the more western nations of Europe, Russia in the last two centuries has gained dominion over all northern Asia, and penetrated into America. Her ancient and new dominions presenting another peculiarity, they were constantly in contact, and, with the narrow sea or strait between America and Asia, remain an unbroken zone on the earth, comprising 200 degrees of longitude. The further extension of this belt, encircling already five-ninths of the planet, was at least for the present arrested by another rapidly developing power, the United States, which occupies 62°, out of the 160° of longitude left between the two extremes of the Russian empire.

The central regions of both the great sections of America, had, in the early ages of discovery, less fame for the exuberant production of gold and silver, than had in after times the northwest coast of North America for the abundance and richness of its furs. Amid pretensions on all sides, the priority of discovering the approaching extremes and intermediate straits, is accorded to Russia. One of the captains in the employment of that empire, Behring, a Dane, in 1741, discovered and named the remarkable strait uniting the oceans of the two hemispheres. From that time, in the progress of human numbers and action, the entire coasts and islands of both continents were successively explored, and Russian settlement slowly extended to the eastward. Russia in fact claimed the coast of North America to within five degrees of the mouth of Columbia or Oregon river, and asserted her claim by the following proclamation (Ukase) in September 1821:

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* Lyman's Diplomacy, vol. ii. page 118.

"Section 1. The pursuits of commerce, whaling and fishery, and of all other industry on all islands, ports, and gulfs, including the whole of the northwest coast of America, beginning from Behring's straits to the 51st degree of northern latitude, also from the Alutian islands to the eastern coast of Siberia, as well as along the Kurile islands from Behring's straits to the south cape of the island of Urup, viz. to the 45° 50′ northern latitude, are exclusively granted to Russian subjects.

"Sect. 2. It is, therefore, prohibited to all foreign vessels, not only to land on the coasts and islands belonging to Russia, as stated above, but, also, to approach within less than one hundred Italian miles. The transgressor's vessel is subject to confiscation along with the whole cargo."

Mr Lyman enters into a rather tedious review and refutation of the Russian claims so sweepingly expressed in the Ukase, which were indeed not pertinaciously persisted in by Russia herself, as with far less previous discussion than attended many other cases mentioned in this review, an amicable arrangement was made the 5th of April 1824, by a convention, containing amongst others, the following stipulations:

"Art. 1. It is agreed, that in any part of the great ocean, commonly called the Pacific Ocean, or South Sea, the respective citizens or subjects of the high contracting parties shall be neither disturbed nor restrained, either in navigation or in fishing, or in the power of resorting to the coasts, upon points which may not already have been occupied for the purpose of trading with the natives, saving always the restrictions and conditions determined by the following articles."

"Art. 2. With a view of preventing the rights of navigation and of fishing, exercised upon the great ocean by the citizens and subjects of the high contracting powers, from becoming the pretext for an illicit trade, it is agreed, that the citizens of the United States shall not resort to any point where there is a Russian establishment, without the permission of the governor or commander; and that reciprocally, the subjects of Russia shall not resort, without permission, to any establishment of the United States, upon the northwest coast.

"Art. 3. It is moreover agreed, that, hereafter, there shall not be formed by the citizens of the United States, or under the authority of said states, any establishment upon the northwest coast of America, nor in any of the islands adjacent, to the north of 54° 40′ of north latitude, and that, in the same manner, there shall be none formed by Russian subjects, or under the authority of Russia, south of the same parallel."*

We have now given a rapid view of the various treaties or conventions on which the boundaries of the United States depend, and we must be rather forcibly struck, on a summary review, to find so much of the great outlines we have traced which are yet subject to doubtful controversy. On the Atlantic Ocean and the Gulf of Mexico, from the mouth of the St Croix to that of the Sabine, all disputes with foreign states are quieted. Here, nature aided in the decision. On the St Croix river, and from its source, for a distance of about forty miles, the boundary seems fixed; but here occurs a most serious interruption, now a subject of intricate negotiation. From the sources of Connecticut river to the 49th degree of N. Lat. on the Lake of the Woods, the limits are with but inconsiderable exceptions determined. Extending the boundary along the 49th degree, can be attended with only natural difficulties, to the Chippewayan system of mountains, but all beyond is vague.

Though not so expressed in positive terms in the convention of 1824, with Russia, we may regard N. Lat. 54° 40′ as the provisional boundary of the United States on the Pacific Ocean to the north; whilst on the southern side N. Lat. 42° has become, since the ratification of the treaty of Washington with Spain, the definitive limit. The United States, therefore, if we consider the preceding limits fixed, possess twelve degrees and forty minutes of Lat. or 880 statute miles along the Pacific coast. Regarding the main spine of the Chippewayan mountains as the boundary inland, the mean breadth of Oregon would be about 460; the whole comprising an area of above four hundred thousand square miles.

This large territory, very nearly double that of the whole Atlantic slope east of the Appalachian mountains, is, according to Tanner's map of the World, occupied by two great rivers, the Columbia or Oregon, on the south, and Tacoutche on the north. The minute geography of the interior is but defectively known; but the coast has been more accurately explored. That part of the coast opposite the basin of Oregon, is rocky and deficient in harbours; the mouth of that fine river being its only deep, extensive and safe haven, which admits direct communication with the interior of the continent. The northern section, drained by the Tacoutche, presents a complete contrast of character. In the latter, the extensive channel or Gulf of Georgia, winds upwards of three hundred miles, separating the large island of Quadra and Vancouver from the Pacific Ocean. This island stretches from S. E. to W. about 300 miles, with a mean breadth of at least 50 miles, and has gained much notoriety from containing on its ocean coast Nootka Sound.

Dixon's Entrance, north of Queen Charlotte's Island, is the extreme northwestern inlet of the United States. From thence southeastward, and including the Gulf of Georgia, for a distance of six

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[*] Lyman's Diplomacy, vol. ii. page 118.

hundred miles, the coast is broken by innumerable islands and intermediate sounds, bays, and straits.

By reference to the head of CLIMATE, it will be seen that there must be a difference of at least ten degrees in the mean, and twenty or more in the extreme temperature, of the two ocean coasts of the United States. The real cause, why, in all places in the temperate zones of the earth, the climateof western is warmer than that of eastern coasts, is now, we trust, fully determined; the fact has been long observed. This difference is fully as apparent between the two coasts of North America, above N. Lat. 30, as it is between the two opposite coasts of the Atlantic ocean. As far as climate, therefore, is concerned, the Oregon regions, particularly near the sea coast, possess an aerial temperature much more resembling that of western Europe, than of the Atlantic coast of the United States The real difference in soil and facility of intercommunication, afforded by nature, are objects of important comparison, far less advanced towards a satisfactory conclusion.

The period, we predict, is fast approaching, when those vast regions will begin to assume a degree of interest commensurate with their extent and situation. For the present, we suspend any further notice of that, as yet, little explored territory, and proceed to the consideration of matters of more diversified character.

Whether regarded in a moral or in a political light, the diplomacy of a nation may be classed amongst the most important branches of its general history. When treating of *boundaries*, that subject has already been partially discussed; but, acknowledging our obligation to the excellent work of Theodore Lyman, we introduce a sketch of our general diplomacy into the following chronological view of the history of the United States. The chronological manner is adopted as the most convenient for easy reference, and suitable to the work in which it is introduced.

Dates of the original settlement of the colonies from which the United States were formed.

Maine, 1628; grant to Sir Ferdinand Gorges.

Massachusetts, 1620; by the Plymouth Company.

New Hampshire, 1623.

Vermont, as part of New Hampshire, 1724.

Connecticut, 1633, by emigrants from Massachusetts.

New York, 1609, by the Dutch.

New Jersey, not certain, but probably before 1620, by Hollanders and Swedes. Patent, as separate from New York, 1664.

Pennsylvania, by the Swedes, 1627. Under William Penn, May 1681.

Delaware, by the Swedes, 1627.

Maryland, on Kent Island, by William Clayborne. Patent to Lord Baltimore, 20th June 1632.

Virginia, April 1607, by London Company.

North Carolina, about 1650, by emigrants from Virginia and Massachusetts.

South Carolina, 1670, by Lord Clarendon and others.

Georgia, 1632, under General Oglethorpe.

Florida, 1565, by the Spaniards.

Alabama, at Mobile, by the French, as part of Louisiana, about 1700. Scattering settlements in the northern part, about the end of revolutionary war.

Mississippi, by the French, at Biloxi Bay, 1699. —French, at Natchez, 1716.—Latter colony massacred, 30th Nov. 1729.—Though few and scattered from each other, permanent civilized settlements were maintained until 1798, when the country was finally transferred to the United States.

Louisiana, 1699, by M.M. D'Iberville and Bienneville.

Arkansas, by the French, as part of Louisiana, about 1700.

Tennessee, 1757, at Fort Loudon, being part of North Carolina.

Kentucky, 1775; part of Virginia.

Ohio, 1787, by a colony from New England.

Michigan, by the French, as part of Canada, 1648—1670.

Indiana, by the French, at and near Vincennes, on the Wabash river, 1690.

Illinois, by the French, at Kaskaskia and Cahokia, 1673.

Missouri, at St. Genevieve, 1763. There were probably small settlements of whites along the right bank of the Mississippi many years previous to that of their formal establishment at St. Genevieve.

Oregon, at the mouth of Columbia, or Oregon river, by a small colony from New York, under the direction of John Jacob Astor, who founded Astoria, 1810.

Date of introduction into the Confederacy.

At a meeting of the continental Congress in Philadelphia, on the 5th of September 1774, there were delegates from twelve of the original thirteen states. Georgia was not represented. In March 1775, however, Georgia named a delegate; and in July of that year, a state convention gave its sanction to the measures of the continental congress. This latter date may be regarded as the consummation of that confederacy, which, in September 1776, by a resolution of Congress, received the national name of the UNITED STATES.

Vermont, though by its aid in arms it was an efficient ally, was not politically a member of the United States during the revolutionary war. After the peace of 1783, New York claimed the territory, and refused to sanction the New Hampshire grants. This impolitic, if not unjust course of proceedings drove the people of Vermont to resistance. After long and often angry negotiation, the legislature of New York withdrew its claim, in consideration of the payment of $30,000.

The consent of congress being obtained, on the 4th of March 1791, Vermont became the fourteenth state of the American union.

Louisiana, Arkansas and Missouri, with the vast unappropriated territory beyond the Mississippi river, became a part of the domain of the United States by the cession of Louisiana, on the 30th of April 1803; and by the final delivery of those immense regions, on the 20th of December 1803, by the French colonial prefect, M. Lausatt, to the United States commissioners, General James Wilkinson and governor William C. C. Claiborne.

The introduction of the new states and territories formed out of the Virginia, Georgia, and North Carolina cessions, may be considered coeval with the date of the respective constitutions of the states, and of that of the formation of the territories. In order of time,

Tennessee ratified its constitution on the 6th of February, 1796.

Kentucky 17th of August 1799.

Ohio, 1st of November 1802.

Louisiana, 22d of January 1812.

Indiana, 10th of June 1816.

Mississippi, 15th of August 1817.

Illinois, 6th of August 1818.

Alabama, 2d of August 1819.

Maine formed its constitution at Portland, on the 29th of October 1819; but as her admission into the Union had become involved with that of Missouri, neither was admitted until March 1820.

Missouri, constitution of, was formed at St. Louis, June 12th, 1820.

The formation of a territorial government in Michigan followed the admission of Ohio and Indiana as states. The territory of Arkansas was formed subsequent to and in consequence of the admission of Missouri as a state.

Florida, as has been already noticed, came under the government of the United States by virtue of an original cession from Spain, and was delivered up to General Andrew Jackson, United States commissioner, in July 1821, since which it has been governed as a territory.

Chronological Review.

1765. There is some difficulty in determining a point of outset, from which the history of the United States naturally emanates from that of the Anglo-American colonies. We have adopted the year of the passage of the stamp act. The English colonies in North America were formed by individual, and not by national enterprise. A spirit of liberty on one side, and of encroachment on the other, produced resistance to power from the very infancy of each colony. The events which arose from this opposition to royal power, were more marked in some than in others of the colonies; but they were more or less exhibited in every one, and the great catastrophe, the revolution, was only a concentrated effort and successful termination of a state of things coeval with the first arrival of British colonies on the shores of North America. In 1765, when the promulgation and enforcement of the stamp act was attempted at Boston, the resentment of the people burst into a flame, which extended its heat along the whole coast. A congress of delegates from each colony, to meet at some nearly central point, was not an unprecedented assembly. A convention or congress had met in Albany in 1754; and was adduced as an example in 1765, when one was proposed by Massachusetts.

There is some obscurity reigning over the claim of the first legislative opposition to the encroachments of Great Britain; but from the best evidence, it seems to have been made by the house of burgesses of Virginia. South Carolina first, however, acceded to the proposal of a congress in 1765, which was followed by all the other colonies, except Virginia, North Carolina, and Georgia, whose governors prevented the election of delegates; and New Hampshire, which dissented from the plan. This congress met in the city of New York, in the latter part of 1765; James Otis, of Massachusetts, taking the lead in opposition to ministerial measures. Though the language and policy of the congress of 1765, were strong, still the proceedings were consonant with the principles of English whigs; and if actual secession from the parent or paramount state was conceived by a few, their views or anticipations were not avowed.

1766. Stamp Act repealed, but with such expressions on the part of the British government, as evinced a conviction on the minds of a majority of its administrators, that they had the constitutional right to tax the colonies, without giving them a representation in the British Parliament.

1770. Discontent on the part of the colonies, and pretension on that of Great Britain continued until this year, when an affray occurred at Boston, between the people and the royal troops. This event, which, although it caused the death of a few citizens, would, in other circumstances, have been of small national importance, was, under the circumstances of the times, a strong mark of the true state of feeling on both sides.

1773. With a view to test their own power, and the extent to which the colonists would carry direct resistance, a heavy tariff duty was laid on tea, and a considerable quantity sent over to America. At Boston, a body of men disguised as Indians threw the commodity into the harbour, while in Pennsylvania and other places the cargoes were returned.

1774. This was a most eventful year in the history of the United States or British Colonies. The act of throwing the tea into the harbour, was a pretext under which the port of Boston was closed by the British government. The place became indeed a garrison-town, and the provincial assembly, disregarding the orders of the governor, met at Concord. This was, in fact, the true point of time at which any colony exercised full sovereignty, and was the real commencement of that unparalleled revolution which gave a new and powerful nation to the earth. At Portsmouth, the British military stores were seized, as were also the royal artillery and military stores in the colony of Rhode Island.

A Continental Congress was called, and met in Philadelphia on the 5th of September; of which Peyton Randolph of Virginia was elected president. Twelve colonies were represented, Georgia alone not sending delegates.

1775. Affairs now rapidly advanced to a crisis. The assembly of Massachusetts had formed a depot of munitions of war at Concord, 20 miles from Boston; to destroy which, a detachment of 800 men was sent from the latter place on the morning of the 5th September. This corps finding a few militia in arms at Lexington, the officer at the head of the royal advanced guard ordered the provincials to disperse, and his troops to fire, on being disobeyed. The British regulars did fire, and the report of their musquets, and the groans of seven or eight citizens slain, sounded a death knell to British power in Massachusetts. The stores at Concord were reached and destroyed, but the whole intermediate country was in arms, and the British had to commence a hasty retreat, assailed by two hostile lines of irregular, but terrible militia. At Concord, lord Percy met the returning and harassed troops with a reinforcement of 900 men and two pieces of field artillery. Nearly worn down with fatigue, the British reached Charleston in the evening, and Boston on the next morning, with the loss of 65 killed and upwards of 200 wounded and missing.

Intelligence of the events at Boston flew like a tempest along the whole colonial coast of British North America, and produced a unanimity of sentiment and action seldom equalled in the great movements of mankind. Weak men are as notorious for their lust of power, as for their utter disregard of the means to secure their authority. They claim power, and expect obedience, and when resisted stand confounded at the arrogance which could set an unsupported mandate at defiance. When the British government shut the port of Boston, and provoked actual hostilities in arms, there were not, from Hudson's Bay to Florida, twenty thousand British regular troops. The only body that deserved the name of an army, then, in what is now the United States, was, within one month after the battle of Lexington, cooped up in Boston by a force of superior number.

In the provincial assemblies and the continental congress, actual secession was not yet openly proposed, though war had commenced. In an attempt to approach nearer to Boston, June 17th, the American forces entrenched themselves on Breed's Hill, near Charleston. A body of 3000 men from Boston attempted to dislodge the provincials, and a sanguinary conflict ensued. The provincials were finally compelled to retreat, with the loss of General Warren and 450 men. The British lost 19 officers killed and 70 wounded, with 1054 rank and file killed and wounded.

Congress was then in session, having met at Philadelphia on the 10th of May. Peyton Randolph was again chosen president, but, returning soon afterwards to Virginia, that very important office was confided to John Hancock of Massachusetts, by whom its duties were effectually discharged. Without finances or even the semblance of a navy, without a single regular regiment, and without either the possession or a well founded hope of obtaining foreign aid, did thirteen small distinct sovereignties enter into a deadly contest with the most powerful maritime nation of the earth. But, under all the circumstances of danger, destitution of resource, and slender tie of union, the most important duty that devolved upon the members of that congress who received the news of actual war, was the choice of a commander in chief. Happy was it for the civil rights of all mankind, that there then existed a native American most admirably endowed with those talents and faculties which suited the crisis. Then of mature age, George Washington was cool and calm, and had acquired habits of reflection; he undertook nothing rashly; and such a man openly taking part with his country, gave a presage of success. When the all absorbing question was discussing, other names were proposed, but as quickly rejected, and this truly great man was commissioned. On the 3d of July, he joined the army at Cambridge near Boston. Washington found himself at the head of 14000 men; but could a body of volunteers, without arms, experience, munitions of war, officers, or engineers, be called an army?

Though Canada was invaded by the Americans towards the end of this year, the war languished. The attack on Canada was ultimately unsuccessful. General Montgomery was killed in an attempt to storm Quebec on the first day of the ensuing year, and the British retained that immense and valuable province.

In the course of this year, Ticonderoga was taken by the provincials. Georgia joined the confederacy, thus completing the THIRTEEN states of the union, and the first constitution of Delaware was formed.

1776. This eventful year opened with the provincials being in possession of New York, and the British of Boston. This order was reversed in the course of the year. March 17th, Boston was finally and forever evacuated by the British army, which was replaced by that under General Washington. There were at that epoch, besides many of lesser note, three very exposed maritime cities on the colonial coast—Boston, New York, and Charleston in South Carolina. Forced to quit the first, the British made an attempt to gain possession of the third. In June, Sir Peter Parker sailed for Charleston with a strong armament, but on the 28th of that month was signally defeated before Sullivan's Island at the entrance of the harbour. In May, the American army had evacuated Canada, and as far as mere military operations were concerned, the account of profit and loss was nearly balanced between the hostile parties. The cause of independence was, however, advancing at no tardy pace. New Jersey framed a constitution of government on the 2d of July, and Virginia on the 5th of the same month. On the 14th of August, Maryland also adopted a constitution. It is obvious, therefore, that what is called emphatically "*The Declaration of Independence*," on the 4th of July 1776, was only the expression of concentrated public will. The individual states were one after another deciding their separation from the parent country. Another proceeding of congress of this year, was of little less moral influence than the Declaration of Independence; the name of UNITED STATES was given as a general term for the whole confederacy.

August 22d, the British landed on Long Island, and on the 27th defeated the United States army at Flatbush near New York; and on the 14th of September, that city was evacuated by General Washington and taken by the British, who held possession of it until the end of the war.

Great confidence was now publicly expressed by congress and the people of the United States, but discerning and reflecting men secretly saw much to fear. The union was nominal. The first fervour became evidently less warm. The military and financial supplies were procured with difficulty and ruinous delay, and in some instances entirely withheld. The continental Congress was really a diet, assembled in one house, with only one deliberative course of proceedings, and with no subordinate departments or executive officers. The President of Congress was in effect only a chairman. The present system was the fruit of time. From the Declaration of Independence, all idea of reconciliation being abandoned, it was natural to seek in the nations of Europe an ally or allies against Great Britain, and as naturally France presented herself, as the power, which from ancient rivalry, recent and lasting causes of enmity, and her immense resources and warlike character, was the most likely to give aid to the revolted colonies. To open a correspondence with Europe, " The Secret Committee of Foreign Correspondence" was appointed in 1775. It was afterwards called " The Committee of Foreign Affairs"—" The Department of Foreign Affairs," and finally eventuated in the Department of State.

" It is not likely that the American provinces in the outset," says Lyman, "expected assistance from abroad." This may have been the case before the Declaration of Independence with the people, generally, but could not have been so with the leaders in the revolution. A letter of M. de Vergennes, dated May 2, 1776, translated and given by Lyman himself,* shows that not only Frenchmen, but France herself, though in secret, had made important advances in aid of the revolted colonies.

September 26th, Benjamin Franklin, Silas Deane and Thomas Jefferson, were elected by Congress as Commissioners to the Court of France. Mr Jefferson was subsequently excused, and Arthur Lee of Virginia named in his place. These, though not so styled, were the first ambassadors from the United States.

The military affairs of the United States declined towards the end of this year; post after post in New York and New Jersey were lost, until, on the 28th of November, General Washington retreated over the Delaware. On the 8th of December the British occupied Rhode Island; on the 12th of the same month, Congress adjourned from Philadelphia to Baltimore; and on the 13th General Lee was taken prisoner in New Jersey, by the British. An intensely cold winter had set in; but, in defiance of its rigours, and the ice of the Delaware, General Washington, with an apparently inadequate force, crossed that river, and on the morning of the 26th broke up the Hessian cantonments at Trenton, killed their commander, and made 900 prisoners.

1777. The first day of this year dawned on what might be called the forlorn hope of the liberties of mankind. With any commander that deserved the title of General, at the head of the British army in New Jersey at that moment, all was lost, but, with his unprovided troops, Washington out-maneuvred the British officers, got into the rear of Trenton, and on the morning of the 3d of January carried their post at Princeton, made three hundred prisoners, and compelled their force on the Delaware to retreat to New Brunswick. The operations of war were, in the early part of the year, however, rather skirmishes or predatory, and productive of but little effect on the real issue of the dispute. The adoption of the constitution of New York on the 20th of April, and that of North Carolina on the 18th of December, formed indeed the most important events in the history of the United States during this year. The military events became important as the year advanced. March 23d, the stores at Peak's Kill on the Hudson were destroyed by the British. April 26, a similar disaster took place at Danbury in Connecticut. July 6th, the British General Burgoyne took Ticonderoga; the first operation in his eventful and finally disastrous campaign. Early in September, another British force advanced by water to the head of Elk, there landed, and on the 11th defeated the United States army at Brandywine, and on the 27th took possession of Philadelphia.

Burgoyne advanced towards Albany, and reached Stillwater near Saratoga, where a sanguinary battle with the United States army under General Gates took place on the 19th of September. A detachment of the British army, chiefly Hessians, had been defeated, on the 16th of August, near Bennington in Vermont, by a body of militia under General Stark. Embarrassed thus by defeat on his left, and a superior and increasing army in his front, Burgoyne found advance or retreat equally difficult, but persevered in the former attempt until the 7th of October, when his army was defeated in the second battle of Stillwater. This was decisive, and on the 17th of October the British General surrendered his army prisoners of war.

National and individual pride alone on the part of the British ministers and people, instigated a continuation of the attempt to coerce their colonies after the surrender of Burgoyne and his army. One of the natural and inevitable consequences of such success on the part of the colonies, was an alliance with France. Before the news of this great event reached Paris, the expressions of the French ministry to the American commissioners denoted, in the language of Arthur Lee, " A kind of trembling hesitation. It is in consequence of this, that the promises, which were made me by the French agent in London, have not been entirely fulfilled."

This state of hesitation terminated early in December, when despatches reached the United States' commissioners, containing a detail of the surrender of Burgoyne and his army. Almost immediately on the receipt of this account, M. Gerard, by direction of his government, formally communicated to the commissioners that the French monarch had come to the determination to acknowledge the independence of " The United States of America," and enter into negotiations preparatory to treaties of alliance and commerce with them. This proceeding was in effect acknowledging their independence, and was followed on the 28th of the same month by a formal conference with Count de Vergennes, at Paris.

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* Vol. i. page 25.

1778. Diplomatic proceedings advanced rapidly, and on the 6th of February two treaties were signed; one a "Treaty of Amity and Commerce;" the other a "Treaty of Alliance." Both instruments were signed on the part of France by C. A. Gerard; and on that of the United States by Benjamin Franklin, Silas Deane, and Arthur Lee. These treaties introduced the new nation into the great family of civilized states, though many of those states were rather reluctant to acknowledge the affinity. Their completion, a matter of most deep importance to them, was quickly made known to the British ministers; who, we are now fully informed, considered the contest hopeless. In another part of this article, we have noticed, that, from the year 1778, the United States could have had peace with Great Britain, on the terms demanded by the former in 1774—75, but that independence having been once declared, the latter retracted its offer, and the colonies, secure of nationality, refused to return to subjection to proconsuls, under any disguise.

In February, Lord North proposed, and succeeded in obtaining an act of parliament to appoint commissioners "to treat with congress; to grant pardons and immunities; to restore to the colonies their ancient charters; to exempt them from taxation, and not to require them to renounce independence, till the treaty had been ratified by the king and parliament."

In a philosophical view of history, we are arrested at every page, and compelled to pause and reflect on human crimes and human folly. Not one demand of the insulted colonies could be even examined in the British legislature in 1775; and at the same time, there was not a sane-minded individual who really made himself moderately acquainted with the circumstances and state of the world, that must not have foreseen the event.

Commissioners under Lord North's act were named, and sent to the United States. Congress refused to receive them, and the attempt to regain the colonies became abortive, as it is probable it had been expected by the projector.

The British commissioners were dismissed in June, and on the 18th of that month the British army evacuated Philadelphia, retreated through New Jersey, where, on the 28th, they were overtaken at Monmouth, and defeated by the United States army under General Washington.

Events of more importance than partial and indecisive affairs in the field, now rapidly followed each other. The treaties of February were promulgated in March, and their signature communicated to the British government by the French ambassador, the Marquis de Noailles. In April, Count d'Estaing sailed from Toulon, with a powerful squadron for the American coast; bringing out in his flag-ship M. Gerard, as ambassador from France to the United States. This minister was received by congress on the 14th of July, with sincere joy and unfeigned solemnity. It was, indeed, a most solemn and momentous occasion; it was the reception of the first ambassador that had ever come from Europe to an independent nation of America.

The compliment paid to the United States by the sending out of the Sieur Gerard as minister plenipotentiary, under the sign manual of the king, was returned in the person of Benjamin Franklin, who was appointed by congress minister to the court of France on the 21st of October 1778. He was the first minister plenipotentiary appointed to a foreign government by the United States; and he was more; he was the first minister, with full powers, sent by an independent civilized nation of the western, to a government of the eastern continent. It may be here remarked, that Benjamin Franklin, when appointed ambassador to France, was approaching the completion of his 73d year, and that this man had the unequalled felicity to put his name to the first two treaties with France, and to that of 1783 with Great Britain.

The prosperous events of 1778; the alliance with France; the arrival of a powerful French fleet; and the evacuation of Philadelphia by the British; were, towards the end of the year, in some measure counterbalanced by the invasion and momentary conquest of Georgia by a British army. In December, Colonel Campbell was detached to the southward, and on the 29th, he captured Savannah from the American forces.

1779. With 1779, the war of the revolution may, with some very partial exceptions, be said to have terminated northward of the Delaware; but, on the other hand, it raged with fury in the southern states. The conquest of Savannah suggested and aided the British in their attempts upon South Carolina. Early in this year the command of the southern United States' army was given to General Lincoln. The British extended their posts along the Savannah river, and on the 3d of March defeated the Americans, under General Ash, at Briar creek, and made a bold but abortive attempt to surprise the city of Charleston. Along the coast, a war of depredation and ruin was adopted by the British commanders, now, hopeless of permanent conquest. In May, Norfolk, in Virginia, was taken and sacked. On the 5th of July, New Haven, in Connecticut, was plundered; and two days afterwards the villages of Fairfield, Green Farm, and Norwalk, were plundered and burned. The taking of Stony Point, by a force under the command of General Wayne, on the 16th of July, afforded the United States some compensation. A much more solid success was, however, obtained on the 23d of September, because it was so far wounding the right arm of the British—their navy. On that day, Commodore Paul Jones captured two of their frigates off Flamborough Head, on the coast of Yorkshire, England.

The French fleet had been in the waters of the United States more than a year, without having visibly influenced the issue of the dispute in which the ally of France was engaged. Towards the end of 1779, Admiral d'Estaing was induced to sail to the southward, in order to aid in an attempt upon Savannah. From want of concert, probably, this expedition had a fatal termination. Contrary, it is said, to the opinion of General Lincoln, it was determined to make an assault. After the arrival of the French and Americans, the British had strengthened their works, and they repulsed the assailants, who left about a thousand men dead or wounded before the place. It was on this sanguinary occasion, that the celebrated Count Pulaski was slain. The attack was made on the 9th of October, and closed the campaign.

The moral influence which time was increasing, did infinitely more for the United States, than petty warfare, which it is disgusting to record. In another part of this article, we have noticed the incipient stage of commercial negotiation between the United States and the republic of the Dutch Netherlands. Congress made no open preparations before the month of October 1779, to form a direct communication with the Dutch Republic; but it is an extraordinary fact, that a treaty had been actually formed and signed between the United States and the Dutch Republic at Aix-la-Chapelle, on the 4th of September 1778, by the United States commissioner, William Lee, and John de Neufville, but without the authority of either government. Neufville acted by the authority of M. Engelbert Francis Van Berckel, pensionary of the city of Amsterdam. The Dutch government disavowed the treaty, but refused to punish the framers.

1780. Their success at Savannah, and the obvious necessity of their gaining possession of Charleston to secure permanent authority in the south, induced the British to send, early in January, Sir Henry Clinton, with a large land and naval force, against South Carolina; and while war and desolation reigned in the south, the constitution of Massachusetts was formed on the 2d of March. On the 21st of the same month, Charleston having been closely invested, it was forced to surrender on the 12th of May. In June, Lord Cornwallis succeeded Sir Henry Clinton as British commander in the south, and General Gates succeeded General Lincoln on the part of the United States. The latter reached South Carolina in August, and was almost instantly met and defeated, on the 16th, at Camden. Here fell Baron de Kalb, a foreign officer of great merit.

The British, in possession of South Carolina and Georgia, regarded the south as restored to the British crown; but amid defeat and extensive defection, two men arose who supported the cause of their country, when despair hung heavy around them. These men were Generals Sumpter and Marion. There was also a war in the interior, beyond the head of tide-water, against which British power could not efficiently act. This war was maintained by men who, in the rough garb of hunters, sallied forth on many occasions as the champions of a depressed cause. While such men as Sumpter and Marion kept up the public spirit in the east, Colonels Campbell, Cleveland, Shelby, Sevier, M'Dowell, Lacey, Hawthorne and Hill, issued from the back settlements of Virginia, North Carolina and South Carolina, with 1600 men. These warriors, to whom individually a bed or board was a luxury, and for whom a roasted ear of corn was sufficient for a dinner, were by far the most formidable foes a British regular force could meet. This dreadful corps encountered Colonel Ferguson and his regulars and tories at King's Mountain, on the 7th of October. Ferguson fell, as did a great part of his men, killed or wounded, and few escaped.

The southern war was murderous and vexatious, without producing any of those decisive events which determine a contest. Gates, though not charged with any act of great weakness, or suspected of defection, and preserving a character in a high degree honourable, was superseded by Greene, who, with Morgan, arrived at Charlotte on the 2d of December, and assumed the command of the southern army.

The year 1780 was rendered remarkable by the depreciation of the paper money. Attempts were made, and in part were successful, to borrow money in Europe. With something of hesitation in the manner, France was an active and effective ally; and her aid in finance was perhaps of more real utility than in arms. The Bank of North America, the most ancient chartered institution in the United States, was this year projected in Philadelphia, under the auspices of Robert Morris and others. This institution was of great national service. But nothing, it seems, could save public credit or the paper money. Individuals were ruined; but the evil day passed, and with it the calamities which it produced.

1781. Though Greene, Morgan, Sumpter, Marion, and many others, were officers worthy of the cause which they sustained, yet the southern section of the United States could scarcely be said to possess an army to oppose the British at the beginning of this year. The British army was well appointed, and little could be anticipated as to the issue. Greene gave the command of his left to Morgan, who first advanced to Ninety Six (now called Camden), in South Carolina; then slowly and cautiously retreated before the impetuous Tarleton, until the British were drawn into an advantageous position for their enemy, and were defeated, on the 17th of January, at the Cowpens, Spartanburg district, South Carolina. Henceforth events crowd upon each other. Active as was Cornwallis, he found enemies not less vigilant. Inferior in number and discipline, the provincials counterbalanced their disadvantages by extreme activity. After severe marching and countermarching, in the spring months, the two armies respectively under Greene and Cornwallis, met on the 15th of March at Guilford Court House, North Carolina. The victory was gained by the British, but with the loss, by death or wounds, of half their army. The active and able partizan operations of Sumpter, Marion, and their associates, were, it is probable, really more effective on the general result, than the more splendid movements of the main army. On the 25th of April, General Greene was defeated at Hobkirk Hill, near Camden, in South Carolina, by Lord Rawdon; and on the 6th of September, New London was burned by a British force, under the traitor Arnold.

The French fleet, since its arrival in the American seas, had yet done less apparently for the common cause, than was expected; but the time had at length arrived, when the aid of a powerful naval force was decisive. Count de Grasse, now admiral in chief, had entered the Chesapeake when Admiral Greaves, with 20 sail of the line, made an attempt to relieve Lord Cornwallis, then slowly falling between the northern and southern armies of his enemies. On the 5th of September there occurred a partial engagement, sought for by De Grasse, to favour the entrance of another French squadron of eight line of battle ships. The object was gained; the French fleet returned to the Chesapeake, and the British fleet to New York, leaving Cornwallis and his army to their fate. The British general had advanced from the Carolinas into Virginia, and early in Septemper took a position near the mouth of York river, at Yorktown. Combined with a naval force, this position would have been excellent; but blocked up by sea, it became a *cul de sac*. Generals Washington and Rochambeau reached Williamsburg on the 14th of September, and in the course of the month cautiously, but securely and totally, invested the British army in Yorktown; and here Cornwallis, relinquishing his once brilliant hopes of conquest, surrendered his army on the 19th of October, and to all moral or physical purposes closed the mighty contest.

December 31st, the Bank of North America was finally established.

1782. In military operations, the events of this year were few, and of minor importance; but in the much more influential subject of diplomacy, it was rendered remarkable, as adding a second nation of Europe to aid the cause of the United States, and to enter into a treaty with the new western republic. We have already shown the incipient steps by which the Dutch Republic was drawn into a negotiation with the United States. This protracted negotiation produced a war between Holland and Great Britain, before the former had as a nation entered into any stipulation with the revolted colonies; but to all military and naval purposes, the Dutch were the allies of the United States previous to the existence of any actual political connexion between the two nations. The treaty with the Dutch, after long delay, was finally signed, on the 8th of October 1782, by John Adams for the United States, and George Van Randwye and the deputies of the seven United Provinces, for the Dutch. The treaty must have been, however, regarded in Holland as virtually in force, previous to the signatures of the negotiators being formally attached, as large loans of money had been procured from the merchants of Amsterdam in September. The provisional articles of peace with Great Britain soon followed the treaty with Holland. November 30th, these preliminary articles were signed, as has already been noticed in a former part of this head.

1783. This most eventful year in the history of the United States was ushered in by an armistice between the United States and Great Britain. January 20th, the armistice, declaring a cessation of hostilities, was signed at Paris by John Adams and Benjamin Franklin, on the part of the United States, and by Alleyne Fitzherbert, on the part of Great Britain. February 15th, the treaty of amity and commerce with Denmark. March 24th, Spain formally acknowledges the independence of the United States. April 3d, treaty of amity and commerce with Sweden, signed at Paris, by Benjamin Franklin and Gustavus Philip de Creutz. In the month of July, Russia acknowledged the independence of the United States. September 23d, definitive treaty of peace between the United States and Great Britain, signed at Paris, on the side of the United States, by John Adams, Benjamin Franklin and John Jay.

The independence of the United States was acknowledged. Ample boundaries were allowed them, comprehending the fertile and extensive countries on both sides of the Ohio, and on the east side of the Mississippi. They were also allowed the right of fishing on the banks of Newfoundland, and in all other waters hitherto visited for that purpose by both nations. Peace was proclaimed in the American army on the 19th of April, just eight years from the memorable day when the first blood was shed between the colonies and the parent state, in the fields of Lexington and Concord.

The circumstances of the brave Americans who had spent the prime of their lives in the sanguinary and protracted combat, drew forth the commiseration of every generous breast. The states, which owed to them their political existence, were unable, at this period, to fulfil their stipulations with their troops; and several of the states were unwilling, through selfish motives, to join with Congress in establishing a uniform rate of import duties, to create a fund for doing justice to them hereafter. Officers and privates were about to be dismissed, many of whom had not, for five years, received the smallest pecuniary compensation, to reward their dangers and fatigues, or cancel the debts contracted in their absence by their families. Consequences the most serious were apprehended. Anonymous letters were circulated, to inflame the minds of the unrequited forces, and induce them to insist upon a redress of grievances, before they parted with their arms. The dignified coolness and humanity of General Washington successfully interposed to allay the storm; and soon afterwards Congress passed a law giving some relief, which, though very inadequate to compensate the officers for their services, yet had the effect of inducing them to retire to their respective homes. On the 18th of October, the army was disbanded by proclamation; and on the 23d of December, General Washington resigned his commission to Congress, then setting at Annapolis, and retired to private life.

The important revolution, as regarded their dependence on Great Britain, required a corresponding alteration in the governments of the individual states. This had been recommended by the general Congress at an early period of the war. Except in Rhode Island, which retained the charter granted by Charles II. conventions were assembled, which formed new constitutions agreeably with the strictest principles of republicanism, retaining whatever was desirable in the original institutions, and providing every additional security against tyranny and corruption, that ingenuity or experience could dictate. The statute and common laws of England, formerly observed in the colonial courts of justice, remain in practice, as before, unless altered or annulled. The inestimable privilege, of British derivation, a trial by jury, and also the freedom of the press, are declared fundamental principles of the newly adopted constitutions. No hereditary honours can be granted; nor are any titles, except those which designate an office, recognised by law. There is only one deviation from the latter essential mark of the republican spirit. Massachusetts has conferred the ephemeral title of "his excellency," upon the governor; and upon the lieutenant-governor of the state, that of "his honour." The governments resemble in their principal organization the frame of the new federal constitution, of which we shall hereafter speak. They consist of three branches; a governor, a senate, and a house of representatives. To enable the public to have the services of men, who, with integrity and talents, possess not adequate means of support when absent from their usual business, compensation is allowed to members of the legislature, during their journey to, and attendance at, the seat of government; a regulation similar to the ancient practice in England. That frequent recurrence may be had to the judgment of the people, the terms of representative service are short. Elections for the lower branch are in general made yearly. The votes are, in some states, given by ballot, in others, by open voice; each mode having its advocates, as it is difficult to ascertain, whether, in practice, the former method is entitled to a preference.

1784. The most important occurrence in the history of the United States, during this year, was the sailing of the ship Empress of China, from the city of New York for Canton, being the first voyage in pursuit of a commerce which has since so greatly augmented.

1785. On the 10th of September, in this year, was formed the first treaty between the United States and Prussia; and on the 26th of June, the following year (1786), a treaty of peace and friendship with the emperor of Morocco.

By the treaty of independence, large territories, which had not been granted to individuals, were ceded to the United States. But these lands were included within the chartered limits of particular states, and were in actual possession of the aborigines. Ample cessions were, however, made in favour of the nation, by the former; and a large tract of country, situated to the northwest of the Ohio, was surrendered by the latter, on condition of their enjoying the friendship of the United States, and a regular supply of merchandise. Having joined the British in the revolutionary contest, they were considered, by the laws of war, as a conquered people; a principle which was mentioned to their leaders, and upon which the terms of this arrangement were in a great measure conducted. But there yet remained for discussion a subject of much higher importance. The general government was not established on a solid foundation. The articles of union, formed under the pressure of common danger, were found inadequate to the efficient management of the same country in the selfish periods of peace and security. It was necessary that there should be a radical reform. The original compact required the concurrence of seven states to every act, and of nine to several higher objects of legislation. It frequently happened, that some of the states were not represented in the general congress; or perhaps by only one member, or by an even number, equally divided in opinion; cases, in which their votes were of no effect; and this bond of union was defective, not only in its powers, but in the mode of executing them. Moreover, no efficient fund being provided to pay the interest of the national debt, the public securities of the United States fell to one-tenth of their nominal value. The soldier could not receive payment for his revolutionary services; the moneyed man, who had trusted his country in the hour of its distress, was deprived not only of his interest, on which he depended for support, but of a great part of his capital. A necessity was created, or an apology furnished, for the non-payment of private contracts; mutual confidence received a deadly wound; and the morals of the people became seriously impaired; evils which General Washington, on resigning his commission, had predicted. These sufferings were increased by restrictions on American commerce. The intercourse with the British West India islands, from which the colonies had derived large quantities of gold and silver, was forbidden to them by the English government, in their new character of independent states: Spain denied their right of navigating the Mississippi: and in danger of capture by the Algerines, they could no longer safely enter the Mediterranean; an advantage which they had always enjoyed when a part of the British empire. Thus, when the people supposed their troubles at an end, they found that they were only varied; that they had obtained liberty, without the concomitant blessings of freedom; the name, without the attributes of a nation.

1786. Feeling the pressure of their sufferings, and unprovided with a remedy, because unacquainted with their source, the inhabitants became uneasy; and many were ready to adopt any desperate measures that turbulent leaders would recommend. Several thousand disorderly citizens of Massachusetts, headed by Daniel Shay, who had been a subaltern officer in the revolutionary war, complaining of heavy taxes, threatened to march to Boston, and compel the general assembly to reduce them; attacked the arsenal at Springfield, and thus opposed the laws which their own authority had framed; however, the insurgents were speedily dispersed, with inconsiderable loss of lives. The friends of social order and national respectability were not idle spectators of this accumulating danger. In accordance with a motion of James Madison, a proposal was made by Virginia to all the other states, to meet in convention, for the purpose of digesting a form of government equal to the exigencies of the Union. Delegates from every state, except Rhode Island, met in Philadelphia, on the 25th of May 1787; chose General Washington president; and, after deliberating until the 17th of September, agreed on a new plan of national government. This being transmitted to the state legislatures, was by them referred to conventions, specially appointed in each by the people; and at length, but not without considerable opposition, was adopted in the following order of time:

Delaware, December 7, 1787.
Pennsylvania, December 12, 1787.
New Jersey, December 18, 1787.
Georgia, January 2, 1788.
Connecticut, January 9, 1788.
Massachusetts, February 6, 1788.
Maryland, April 28, 1788.
South Carolina, May 23, 1788.
New Hampshire, June 21, 1788.
Virginia, June 26, 1788.
New York, July 26, 1788.
North Carolina, November 21, 1788.
Rhode Island, May 29, 1790.

The accession of nine states was necessary to give force to this constitution, therefore New Hampshire, being the ninth state that acceded to it, decided the important question.

By the new constitution, all legislative powers are vested in a congress of the United States, consisting of a senate and a house of representatives. The executive power is vested in the president, who must be a natural born citizen, or have been a naturalized citizen of the United States at the time of the adoption of this constitution; of the age of thirty-five years, fourteen of which he must have resided in the country. He holds his office during the term of four years; and, together with a vice-president, chosen for the same period, is appointed by electors, chosen according to regulations of the several states. The president is commander in chief of the land and sea forces of the United States, and of the militia of the individual states when called into the general service. The vice-president is ex officio president of the senate, but has no vote except when the senators are equally divided; and in case of a vacancy in the office of president, the duties thereof devolve on the vice-president. The senate is composed of two persons from each state, chosen by its own legislature for six years. A senator must have attained the age of thirty years, and been nine years a citizen of the United States. The house of representatives is composed of members elected every second year, by the people in the several states having the same qualifications that are necessary to entitle them to vote for delegates to the most numerous branch of their respective state legislatures. No person can be a representative who has not attained the age of twenty-five years, and been seven years a citizen of the United States.

Congress assembles at least once in every year, which meeting is fixed to be on the first Monday in December. Members of both houses receive a compensation for their services; and, like the members of the British house of commons, are privileged from arrest during their attendance, and on their journey, in all cases except treason, felony, and a breach of the peace. Congress has power to lay and collect taxes, to pay the debts and provide for the common defence and general welfare of the United States; to borrow money; to regulate commerce; to establish a uniform system of naturalization; to coin money, and fix the standard of weights and measures; to establish post-offices and post-roads; to declare war, grant letters of marque, raise and support armies, and provide and maintain a navy. No title of nobility can be granted by the United States; nor can any person holding any office of profit or trust under them, accept of any present, emolument, office, or title, from a foreign state, without the consent of Congress.

The United States guarantee to every member of this great political family, a republican form of government; and are bound to protect it against invasion and domestic violence; and no religious test is ever to be required as a qualification for any office under the United States.

The judicial power of the United States is vested in one supreme court, and in such district and circuit courts as congress shall think proper to direct.

Thus were established two separate governments over the Union; one, for local purposes, over each state; the other, for national purposes, over all the states, by the people, as citizens of the United States.

1789. The first congress under the new constitution assembled in the city of New York, on the 4th of March; but, from accidental causes, the election of General Washington to the presidency was not officially announced to him at Mount Vernon until the 14th of April. On the 30th of the latter month, that truly great man was inaugurated president, and John Adams, of Massachusetts, vice-president of the United States.

1790. To replenish the empty treasury was the first object of legislative attention. For this purpose, duties were laid upon imported merchandise, and reasonable taxes imposed upon the tonnage of vessels. The next object was the support of public credit. In the month of January, Alexander Hamilton brought forward a system, luminous in its detail and ingenious in its application; perhaps the best that could be devised, to unite the conflicting interests; and which, after having been met by an amendment advocated by James Madison, was, with little variation, adopted.

To complete the financial department, Mr. Hamilton recommended the formation of a national bank; an institution which was strenuously opposed, but at length sanctioned, by an act of congress. The bank was chartered for twenty years from the 3d of March 1791, its capital being ten millions of dollars. Branches, termed offices of discount and deposit, were established in the principal sea-ports of the United States; the parent bank being placed in Philadelphia, at that time the seat of government. At the same time, also, the mint of the United States was established.

This year, the first census was taken of the population of the United States; by which it appeared that the number of inhabitants was 3,929,526.

1792. Kentucky owes its political existence to the liberal spirit of Virginia. Originally part of her territory, she authorised and encouraged the former in the establishment of a separate government, to be organized by the free voice of its own inhabitants; and the consent of congress having been obtained, by an act passed on the 4th of February 1791, Kentucky was, on the first day of June, in the present year, admitted into the Union, on the same terms as its indulgent parent.

The extension of settlements beyond the Ohio was much retarded by the hostile disposition of the Indians. Compelled through necessity to make a seeming relinquishment of those lands, on which they had drawn their earliest breath, and ranged undisturbed in pursuit of their favourite games, these untutored children of the forest, like the sophisticated politicians of the eastern world, adhered to their agreements no longer than they were restrained by interest or fear. The Indians were now a formidable people. They had been instructed by the French in the use of European arms, and had acquired considerable knowledge of their discipline. In the south, the Creek Indians had been at war with Georgia: peace, however, was restored there in 1790; in consequence of a treaty signed by their chieftain, M'Gillivray, at New York. Pacific overtures, made to the north-western Indians, were rejected. In the following year, General Harmar was despatched with an army of 1400 men, to destroy their settlements on the Scioto and the Wabash; but the militia being panic-struck, the expedition was defeated, with considerable loss; and the next attempt against those people, under the command of General St. Clair, was still more disastrous.

1793. General Wayne, who succeeded St. Clair, having, in September of this year, reached the ground where that officer had been defeated, and erected a fort, brought the insidious enemy to a general engagement, on the 20th of August, in the ensuing year (1794), when he completely routed them, drove them out of the country, and soon afterwards erected forts in the midst of their late settlements, to prevent their return.

1794. This year, General Wayne concluded, at Greenville, treaties with the hostile Indians northwest of the Ohio; by which peace was established on terms mutually satisfactory and beneficial. A humane system now commenced for ameliorating their condition. They were henceforth protected by the United States from the impositions and incursions of lawless white people; taught the use of the loom; and encouraged in the pursuits of agriculture: measures reflecting high credit upon Colonel Hawkins, who was amongst the first to execute the benevolent intentions originally projected by the humane spirit of General Washington.

But, at the very time when the country was enjoying unexampled prosperity from the administration of an efficient government, its authors were loaded with execrations, and branded as a despotic aristocracy by a large portion of their fellow citizens. A criminal resistance was thus promoted to the payment of the excise duty on domestic spirits. The duty was particularly obnoxious to those inhabitants of Pennsylvania who dwelt on the western side of the Alleghany mountains; and though, in order to remove every pretence of grievance, the law was revised, and all reasonable objections were cancelled or amended, the very *principle* itself being an object of hostility, it was necessary for the president to make a requisition of a large body of militia from the governors of New Jersey, Pennsylvania, Maryland, and Virginia, and to order a formidable number of these into the field, before the insurgents, who were supposed to number not less than 7000, were induced to withdraw to their homes, and cease their criminal resistance to the laws, which, as citizens of the Union, it was their duty to obey and to protect.

Leaving, for the present, the concerns of our own country, we will turn our attention to the situation of affairs in Europe.

Emboldened by the success of the American revolution, the people of France had proceeded in their endeavours to obtain freedom, until they had deprived their unhappy monarch of his sceptre, and finally of his life; and were now contending single-handed against the surrounding states. In this situation, the French directory turned their eyes towards America, and demanded, in the friendship and assistance of the American colonies, a return for the aid rendered to them by Louis; an aid given by a sovereign whom they had deposed; whose interest was unconnected with his people's; and that the United States would violate the bond of peace, the attainment of which was the only merit claimed by their former allies. The minister appointed by their fallen monarch having been recalled from the United States, M. Genet was sent over in his place. This envoy treated the American republic more like a tributary vassal than a country holding a high rank amongst independent nations. In a few days after his landing, which was at Charleston, he undertook to authorise the arming of vessels in that port, and the enlisting of men; giving commissions, in the name of the French government, to cruise at sea, and commit hostilities on land, against nations with which the United States were at peace. The British minister remonstrated. The president, before the arrival of Genet, had determined on the line he should pursue, which was a strict neutrality; and issued the proper orders for defeating the unwarrantable measures of the French ambassador. A large body of the people, however, were at this time favourable to the French encroachment;—some, enlightened men, who were willing to sacrifice every thing to aid a country struggling for liberty against a world in arms; many, through a desire of profit; and more through ignorance,—anxious to repay an obligation, yet unable to discover to whom they were obliged. Encouraged by these generous feelings, Genet designed a measure unexampled in the page of history. He threatened an appeal to the people. They, he declared, and not the delegated authorities, possessed the sovereignty, in a democratic state. This appeal offended and alarmed all who felt for the independence of their country. The president requested that he should be recalled, and he was accordingly suspended. His successors were less violent in their deportment, but nearly similar in their designs. Every day gave indications of an open rupture. Not contented with seizing enemies' property when found on board vessels of the United States, the French directory authorised the indiscriminate capture of all vessels sailing under their flag; demanded a large sum of money as the price of a negotiation; and ordered General Pinckney and Mr. Marshall, two envoys from the American government, to quit the territories of France.

1797. In the mean time, General Washington, having completed a second period of his executive duties, and declined a re-election for a farther term, was succeeded by John Adams, the late vice president; the office held by the latter being now filled by Thomas Jefferson, late secretary of state.

1798. When the lawless proceedings of the French government were known in the United States, they excited the most extensive indignation. A provisional army was voted by congress, in May, of which General Washington accepted the command. On the 25th of June an act passed to permit merchant vessels to be armed, in order to defend themselves against depredations; authority was also given for capturing French armed vessels, and on the 7th of July, congress, by a solemn act, declared the existing treaty with France no longer obligatory.

1799. Two severe and well-fought actions occurred in the West India seas, in each of which a French frigate struck her colours to the American frigate Constellation, under the command of commodore Truxton.

In relation to the aggressions of France, addresses poured in upon the president from every section of the Union, promising him the most efficient support; and France soon intimated a desire for peace. Envoys were accordingly sent to Paris, where they found the directory overthrown, and the government in the hands of Napoleon Buonaparte, with the title of first consul: all disputes were speedily adjusted, and on the 30th of September 1800, a new treaty between the two republics was concluded.

But there was still another power, the great antagonist of France, with which disputes of not less importance were to be adjusted. This was Great Britain. Although, since the definitive treaty of Paris, there had occurred no open hostilities between England and the United States, yet they were far from being on terms of perfect amity and reconciliation. Soon after the termination of the revolutionary contest, the two countries charged each other with having violated that treaty; a charge, which though reciprocally denied, was reciprocally proved. In this unsettled posture of affairs, Great Britain became opposed to France in the great continental war, which we have already noticed. As France was then generally beloved in the United States, and England in the same degree hated, the hostile feeling that before existed, was thenceforth increased; not only from the previous excitement, but from new causes arising out of the war. The Americans had become the shipping carriers of France; and, adhering to their favourite principle, that "free ships make free goods," were indignant at the frequent searches, as well as captures, of their vessels, and of French property on board. But of this conduct the American merchants could, in justice, only partially complain. By the treaty which ended the revolutionary war, the search of their vessels, and the seizure of enemies' property on board, were formally permitted; notwithstanding that, by a previous agreement between the United States and France, a contrary principle had been sanctioned, as regarded the relations of the latter. As an ultimate resource for the preservation of peace, Mr. Jay, chief-justice of the United States, was deputed, in 1794, envoy extraordinary to London. A treaty was the result of this mission, in the ensuing year. But though more was now yielded by England than at any former period of the negotiation, the concessions made by that power were much less, and on the part of the United States much greater, than were pleasing to a majority of the American people. The military posts detained by England, contrary to the treaty of independence, were now given up, and compensation was made for several of the illegal captures. Their favourite maxim, however, that "free ships make free goods," was abandoned, and the search of their merchant vessels admitted, and the United States agreed to pay 600,000 pounds sterling to the British government, in trust for the British creditors of the Americans; thus settling all grounds of controversy emanating from the revolution. But it was not until the 5th of June 1798, that the last explanatory article of this treaty was ratified by congress.

On the 26th of March, a treaty of peace was concluded between the United States and Tunis; and the first treaty with Prussia having expired by its limitation, a second was signed, at Berlin, on the 11th of July 1799, John Quincy Adams acting as minister plenipotentiary on the part of the United States.

The 14th of December terminated the earthly existence of George Washington, who died at Mount Vernon, in his 68th year.

1800. It had been strongly advised by Washington, that the seat of government should be removed to a place more convenient for the general interest of the United States, than either New York or Philadelphia. Accordingly, at the second session after the formation of the new federal government, his recommendation was adopted. A territory ten miles square, now called the District of Columbia, having been ceded for this purpose by Virginia and Maryland, a city, bearing the name of the illustrious protector of his country was founded on the Potomac, in that portion given by the latter state. The ancient laws of the ceded territory were secured to the respective divisions until altered or repealed; and the sovereign authority of the district was vested in the general congress. This year, the public offices were removed from Philadelphia (the seat of the federal government for the preceding ten years), to the infant capital; in which magnificent buildings had been erected for their accommodation; and Congress met there in December.

1801. At the usual period, before the completion of the presidential term of duty, John Adams was again a candidate for the executive chair, but was successfully opposed by Thomas Jefferson, the candidate of the democratic party in the United States; the vice-president elected at the same time being Aaron Burr.

Harmony now subsisted between the United States and the great European powers. But a new scene of vexation, and eventually of war, was presented by the conduct of one of the Barbary states. The bashaw of Tripoli, regardless of the existing treaty, dismissed the American consul, and threatened speedy depredations on the American commerce, unless certain demands of tribute were conceded; on the refusal of the United States to comply with these degrading terms, he proceeded to the execution of his threats. Several vessels were accordingly captured. But these insults were not suffered to remain long unavenged. The navy of the United States, though small in number, was not deficient in activity and courage. The gallantry displayed in the schooner Enterprise, by Captain Sterrett, was soon followed by naval operations on a larger scale, under the direction of Commodore Dale; and in the ensuing year, 1802, Commodore Murray constrained the barbarian flotilla to retire before him in confusion and dismay. The next naval occurrence, the accidental loss of the frigate Philadelphia, in the harbour of Tripoli, excited considerable regret; but the misfortune, though at the time distressing, afforded an opportunity to Lieutenant Stephen Decatur, by the destruction of the stranded vessel, on the 15th of February 1804, to develope that chivalric intrepidity which, at a later period of our history, and in a conflict with a more formidable enemy, served to raise him to an enviable rank amongst the naval heroes of the age. Commodore Preble, who had been intrusted with the command of the Mediterranean squadron in the preceding year, continued to perform his duty to his country with much perseverance and effect. But these numerous demonstrations of heroic resolution, were not sufficient to break the fetters of captivity, or lessen the rigours of barbarian insolence. The prisoners taken on board the stranded frigate were treated with atrocious cruelty. They encountered cold and hunger, labour, menaces and stripes: they were chained to loaded carts, and, like oxen, compelled to drag them through the town. Every remonstrance made by Captain Bainbridge, in behalf of his companions, was unheeded; every effort to mitigate their sufferings, unsuccessful. Some new experiment was imperiously demanded. It was therefore resolved by the American executive, to try another enterprise, in order to gain the liberation of the prisoners, and a speedy and honourable peace. This was a co-operation with Hamet, the ex-bashaw of Tripoli, who had been driven from the government by the usurpation of his younger brother. Accordingly, William Eaton, of Massachusetts, who had been for many years American consul at Tunis, was despatched to communicate the project to Hamet, and make arrangements for its execution. Eaton performed his part with distinguished lustre. After much embarrassment, he effected an interview with the exiled sovereign in Upper Egypt; where he had associated with an army of Mamelukes, at war with the Turkish government. Hamet was well pleased with the scheme of the Americans, and appointed Eaton commander of the forces destined for its accomplishment; an event that would restore Hamet to his throne. It was designed to penetrate by land into the Tripolitan dominion, with whatever force could be mustered amongst the partisans of Hamet, supported by as many Americans and other christians as felt for the distresses of the imprisoned seamen. On the 6th of March 1805, General Eaton, accompanied by Hamet and his little army began his march from Alexandria, and, after fifty-two days spent in traversing a hideous desert of 500 miles, he arrived before Derna, a city in the regency of Tripoli. The next day, Eaton carried the town by the bayonet; and, though frequent attacks were afterwards made upon the place for the purpose of recapture, that gallant officer maintained it against all the fury of the barbarians.

The brilliant progress of Eaton promised the most glorious and beneficial result. But the fruits of his achievement were blasted before they reached maturity. The object pursued by arms was suddenly attained by a disgraceful treaty. This treaty, made on the 4th of June 1805, with the reigning bashaw, by Tobias Lear, on behalf of the United States, obtained the release of the prisoners for the sum of 60,000 dollars; and engaged that the Americans, in withdrawing their forces, should use their influence to induce Hamet to retire.

Let us now turn from the devastating scenes of war, to the exhilarating effects of domestic peace. Fostered by the parental nature of the government, emigrations from the European world continued to increase. New manufactures were introduced into the United States; the arts and sciences were annually spreading. Hardy labourers, principally from Germany and Ireland, assisted in giving strength to the republic, by an important addition to its numbers. The axe every where resounded through the western forests, and new communities sought association with the old. Since we noticed the establishment of Kentucky in 1792, two other states were joined in the federal constitution,—Tennessee and Ohio, formed out of the ancient dominions of the Union. The former, a portion of the territory of North Carolina, became a state in 1796. Ohio, a part of the territory westward of Pennsylvania, became a member of the general government in 1802, under the first American constitution that declared explicitly against the practice of holding slaves; in conformity with a restriction humanely imposed by congress upon all that region of which it forms a part.

In 1803, Louisiana was purchased from the French government, for the sum of fifteen millions of dollars; two millions and a half of which were to be retained by the United States as compensation for illegal captures made by France. At this period, its population did not entitle it to an independent rank; but a district of it was subsequently admitted to that privilege, and formed the eighteenth member of the American confederation.*

To render the purchase of the utmost benefit, as well as to extend the field of natural science, Messrs Lewis and Clarke, both officers of the regular army, were sent by the president, Mr. Jefferson, with instructions drawn by himself, to explore the river Missouri and the contiguous countries, and discover the best communication with the Pacific Ocean. Never was an arduous enterprise accomplished with more ability and prudence. Accompanied by thirty-five persons, mostly soldiers, they embarked at St. Louis, in suitable boats, in May 1804, and ascended the Missouri to its stupendous falls, a distance of three thousand miles; thence crossed the Rocky Mountains, impeded by their everlasting snows, and descended various streams, until they reached the navigable waters of the Columbia; and, following the course of that river, they were at length recompensed for all their toils and privations by a view of the Pacific. They reached St. Louis, on their return, in September 1806, after an absence from all civilization of more than twenty-seven months, and the performance of a journey of seven thousand five hundred miles.

1807. This period is remarkable, on account of the trial of Aaron Burr, for a serious offence against the laws of the United States. The circumstances that led to so unpleasant an occurrence, and to the tragical fate of a distinguished individual by which it was preceded, deserve to be narrated. At the close of the year 1800, the election for president and vice-president had again occurred; the candidates were, besides John Adams and Thomas Jefferson, the magistrates then in office, Charles Pinkney and Colonel Aaron Burr. Party feeling was high. Strenuous efforts were made to change what was called the "federal administration" of Mr. Adams, for one thought to be more truly democratic. Although the friends of Mr. Jefferson, the democratic candidate, had intended Burr only as vice-president, yet as the latter had an equal number of votes, the awarding of pre-eminence, agreeably with the constitution, devolved upon the house of representatives; and, after the ballot had been taken thirty-six times, Mr. Jefferson was elected to the first, and Mr. Burr of course became entitled to the second office. This scene agitated the public mind more than any of a civil nature that had occurred during the whole administration of the government. It was requisite to guard against a recurrence of so inflammatory a result; and accordingly an amendment was made to the constitution, whereby the electors are directed to designate the individual intended for each office.

From that time Burr, who had been a leading man amongst the democratic party, declined in favour with his political adherents. They suspected that he had connived with the opposition to supplant Mr. Jefferson, and thereby procure his own election. He began to form a plan to recover his former influence. He became a candidate for the office of governor of New York; but his hopes of success were defeated by Alexander Hamilton, long the professional rival and political opponent of Colonel Burr. The consequence was fatal to the former. Having been challenged by the disappointed candidate, a duel occurred between them at Hoboken, in New Jersey, on the 12th of July 1804, when Colonel Hamilton received a mortal wound.

During the ensuing winter, Burr conceived a project of an enterprise in the west. His designs have remained in some degree of obscurity: but public opinion concluded that he intended either a political separation of the western from the Atlantic portion of the Union, or an invasion of Mexico and other Spanish provinces in the neighbourhood of the United States. Having seduced to his interest some individuals of wealth and influence, he assembled a few desperate partisans on the Ohio, and steered his course towards the Mississippi. But the vigilance of the public officers defeated his intentions. He was apprehended, conveyed a prisoner to Richmond, in Virginia; the state in which his adherents had first collected; and on the 17th of August 1807, was brought to trial: but, as the evidence did not sustain the charge of treason with that legal force which the rules of evidence require, he was acquitted.

We must now revert to the affairs of Europe; to those vast occurrences, the destructive influence of which is almost concealed by their sublimity. For a long time after the spoliations on the commerce of the United States had ceased, in consequence of the treaty negotiated by Mr. Jay, their shipping interest experienced few impediments worthy of animadversion. Their merchants were enriched by the European warfare, beyond any previous example: their flag, for many years, was the only one that enjoyed the happy and enviable advantage of neutrality. But that great national blessing was doomed to have a period. When, in the year 1804, the flames of inveterate hostility between France and Britain, which had been merely checked, but not extinguished, by the short-lived peace of Amiens, again burst forth and spread with unequalled fury; and the sentiments of Britain, in refusing to acknowledge the imperial dignity assumed by Napoleon, were responded by all the royal families of Europe; the civilized world was shaken by the awful contest. Every antagonist, except Britain, was crushed by the arms of France. Napoleon's ambition was bounded only by the fleets of England; her fleets were supported by her commeree and manufactures; and to annihilate the one, it was necessary to destroy the others. Britain seemed contending for existence; but, while struggling to avert her individual ruin, she affected to be the bulwark of the world. Flattered by this proud assumption of philanthropy, the encroachments of Napoleon upon neutral rights were met by corresponding obstructions; and when France interdicted all commerce with Great Britain, the latter denounced all commercial intercourse with France. The Berlin decree of 1806, and the Milan decree in the succeeding year (both issued by Napoleon, to prevent the American flag from trading with his enemy), were followed by the British orders in council—not less extensive than the former, in their design, and equally repugnant to the law of nations. France, however, had at this period no power on the ocean. Her fleets had been, by the fate of war, transferred to her victorious rival. On that element, France could wage only a combat of decrees. She was unable to preserve a single cruiser against the superior skill and discipline of the British navy. It was not until the friendly vessels had reached her ports, after sailing from her opponent's harbours, that the confiscations were effected. The plunder, by the other belligerant, could be made at all times; on the ocean, or within her harbours. England was jealous because America delayed resistance to the feeble marine of France: the latter enraged, from the patience with which the neutral suffered the encroachments of England. Both continued their depredations; and each strove to rouse the vengeance of the injured nation against the other.

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* In the year 1812.

But there was a further cause of irritation, arising solely from the conduct of Great Britain. This was the practice of searching American vessels on the ocean, and impressing from them British seamen; a practice at variance with the free principles of the British constitution, when applied to her own, and with the rights of independent nations, when practised against foreign vessels. The seamen, and consequently the trade, of the United States, were affected in a peculiar manner by this proceeding. Using the same language with the native subjects of the British monarch; speaking with the same provincial dialects; resembling them in dress and in personal appearance; it was impossible to distinguish with legal certainty, the sailors of one country from the people of the other; and besides, the United States had always exercised the right of naturalizing, after a certain length of residence, the inhabitants of every nation: England had long been in the practice of extending to foreigners, who entered her naval service, a similar privilege; and it was asserted, that to invade the deck of a ship on the common sea, was an act of hostility, not less than the invasion of the land to which the vessel belonged.

Hitherto, the custom of impressment had been confined to private vessels; but now it was carried to the utmost point to which aggression could extend; and national armed vessels were not exempted from intrusion. Four seamen, deserters from the British navy, being reported to have been received on board the frigate Chesapeake, that vessel was unexpectedly attacked by the Leopard, a British vessel of superior force, to which the American frigate, after four of her men had been killed and sixteen wounded, struck her colours, and surrendered the seamen, though three of their number were natives of the United States.

The indignant feeling which arose from that tragical occurrence, was for a moment lessened by the succeeding conduct of the British government; but soon afterwards new systems of blockade were invented; the catalogue of commercial articles deemed contraband, was still more grievously enlarged; from the amplitude of which, and of the French imperial decrees, a general capture of all American property afloat seemed almost inevitable. Congress, therefore, on the recommendation of Mr. Jefferson, ordered an embargo, prohibiting the exportation of every article from the United States. In a moment, the commerce of the American republic from being, in point of extent, the second in the world, was reduced to a coasting trade between the individual states. Several of these declared against the embargo; and individuals throughout the Union seized every opportunity of infringement. The opposition in the eastern states daily grew more violent. The restriction could not be enforced there, without military coercion. The government, therefore, which for many years had sacrificed largely for the preservation of peace with foreigners, found it expedient to observe a similar conduct at home. 1809. They repealed the embargo law, and substituted a non-intercourse with France and England.

1809. The 3d of March having concluded the administration of Thomas Jefferson, after a second election, he was succeeded in the presidential office by James Madison.

Though reparation was obtained, as far as it was possible, for the insult offered to the national flag of the American republic, much was still to be accomplished. Every experiment had failed in procuring a change of the systems practised by Great Britain and France against American trade. The United States now offered to their consideration, that the non-intercourse would be discontinued towards either of the belligerants, or both, as soon as they, respectively, ceased to violate the neutral commerce of the republic. This alternative proposition caused a line of proceeding singularly artful on the part of France. It enabled her ruler to maintain a peace with the United States, and involve the other power in the calamity of war. Napoleon's minister having informed the American minister resident at Paris, that the decrees of Berlin and Milan were revoked, the non-intercourse, as regarded France, was, by a proclamation of the president, withdrawn. But Great Britain, suspecting the intentions of Napoleon, did not believe that the French decrees were at this period actually annulled. Indeed, when it is considered that nearly two years had elapsed, before a copy of the document, by which the emperor asserted they were repealed, was handed to the American minister; and that its date was seven months earlier than the period of its communication, an impartial observer cannot avoid declaring, that there was greater reason for suspicion than for belief.

1812. The formal publication of the repeal on the part of France was followed by a corresponding retraction on the part of England. But the measure was then too late. When intelligence of the repeal arrived in the United States, war had been commenced against Great Britain. The bill for this purpose was voted in the house of representatives by a majority of thirty members out of 128; in the senate, by a majority of six out of thirty-two; and was confirmed by the approbation of the president, on the 18th of June.

As the question of search and impressment was still unsettled, it was thought to be the interest of the nation that hostilities should be continued, until after a final adjustment of every dispute. Some months before the declaration of war, congress had been seriously engaged in preparing for the contest. The army and navy were considerably increased: the duties on goods imported were in general doubled: taxes were afterwards laid upon certain articles of domestic manufacture; upon lands, houses, and nearly every other description of property. In using these resources, however, great improvidence was shown. From a hope entertained of a favourable issue of the negotiation, or the dread existing in the minds of the legislators, lest they might lose their popularity, internal taxes were not laid on until long after the commencement of actual warfare. The consequence was severely felt: the credit of the government was impaired; and speculators seized the opportunity afforded by a sudden demand for money, and supplied the exhausted treasury by taking debentures at a rate very considerably under par.

The defeat of the Shawanese Indians by General Harrison, on the 7th of November 1811, at the Tippecanoe, was a happy prelude to the commencement of the war against their British allies, by whom they had been incited to assail the white settlers in the neighbourhood of the Wabash river; but the subsequent abortive invasion of Canada, and the surrender by General Hull of Detroit and its numerous garrison, together with the extensive territory of Michigan, on the 15th of August 1812, served alike to depress the rising spirit of the American people, and for a while to justify the opinion entertained by the British ministry, that their disposition was calculated rather to suffer insult in a state of peace, than to avenge their wrongs by an energetic war. On another element, however, ample reparation was made to the injured honour of the country, by a series of gallant victories; and the very first of these achievements, which have served to elevate the character of the American navy to the highest pinnacle of glory, was gained four days after the disgraceful surrender of Detroit, by Captain Hull, a nephew of the general who had inflicted so deep disgrace upon his country's flag. On the 19th of August, the American frigate Constitution, under the command of that officer, captured the British frigate Guerriere, after a severe rencounter; an event which diffused over the country universal joy; and that achievement was followed by a series of actions on the ocean and on the lakes, which evinced not less skill than gallantry on the part of the American commanders.

It would be unjust, did we omit recording in this brief epitome, the names of Decatur, Bainbridge and Biddle; Jones, Lawrence, Warrington and Stewart; as the most distinguished of the naval heroes on the ocean; and those of Perry and M'Donough, as the respective conquerors of the British fleets on lakes Erie and Champlain.

No subject of military tactics, not even the long disputed question, which was the more efficient, the Macedonian phalanx, or the legion of the Roman army, ever created a more eager spirit of inquiry, than during this war did the extraordinary success of the American navy. The British assigned as the cause, the dimensions of their enemy's vessels: the Americans, the voluntary enlistment of their seamen. But neither of these reasons will bear the test of experience. The first is erroneous; because the superiority of a few guns could not produce a continuation of similar results: the second is equally untrue; being contradicted by historical evidence. During the revolutionary war, the British mercenary soldiers almost invariably overthrew the American militia; and in the English navy, no difference has been at any time recorded, between the exertions of the impressed seaman and the volunteer. The cause, however, with proper examination, may be discovered. It arose entirely from the superior accuracy of the American fire; and the point to which the shot was in every instance directed. The French direct their shot towards the rigging; thus hoping to escape from a disabled enemy; the English aim chiefly at the deck, with the design of destroying the crew; but the Americans pursue a system different from either, and combining the advantages of both. They point their guns at the hull of their antagonist, and having succeeded in piercing and shattering her sides, the sinking vessel is compelled to strike her colours.

Feats of naval prowess were not confined to the public ships of the United States. Privateers sailed from every port, and exhibited the same superiority that was displayed by the regular navy. Before the meeting of congress, in November, 250 vessels had been captured from the enemy; and more than 3000 prisoners taken; upwards of 50 of those vessels being armed, carrying nearly 600 guns.

The good effects of these splendid triumphs in promoting confidence, soon extended beyond the element on which they had been gained: a spirit was thereby roused on land, which produced a happy contrast to the previous languor of despondence. In the western and in the southern states, volunteer corps were every where forming, and tendering their services to march to any quarter of the Union. Great alacrity was shown in the western sections of Pennsylvania and Virginia; but this patriotic zeal was the most conspicuously observable in Kentucky, Ohio and Tennessee. It was expected that before October, every thing would be ready for a formidable invasion of Canada; but, from an extraordinary cause, there was experienced considerable disappointment. Unfriendly to the war, particularly to its being made offensive, the governors of Massachusetts, New Hampshire and Connecticut, refused to allow the militia of these states to march under the requisition of the president. They declared, that they were themselves the proper judges, in accordance with the federal constitution, of the necessity which might require them in the field. Their refusal delayed for a short time the intended movements, but did not depress the spirits of the troops collected. Nearly 10,000 men were at length embodied on the northern lines, and skilful sea-officers were employed in forming a navy on lakes Erie, Ontario and Champlain. The indefatigable exertions of commodore Chauncey, in creating a fleet upon those inland seas, produced most beneficial results. During the revolutionary war, the operations on the northern lakes extended not beyond the contests of a few temporary gun-boats, or inconsiderable schooners; but preparations were now making, from which arose a sublimity of combat not less interesting than on the extended waves of the Atlantic ocean.

Thus far the navy had been invariably successful; and the army, though equally brave, had been in almost every action unfortunate. The one had been the early favourite of the party that now opposed the war; the other had been considered by the ministerial adherents, as the only means of national defence (except gun-boats), worthy of attention. When congress re-assembled in November, the glory of the seamen was contrasted with the disgraces of the army, as a fresh argument against the measures of the existing government. Party spirit rose to an alarming height; and as usual, the members of the several legislatures were not less under its influence in their public, than in their private relations. Mutual charges were made, of French control and improper submission to the outrages of Britain. Some degree of justice was apparent on the pacific side; yet the advocates of war were able to produce arguments equally meriting attention. A proposal for an armistice, made by the governor of Canada, had been thought inadmissible; and a similar offer, by a British admiral, was on the same principle rejected: but, on the other hand, the American minister at London had made a pacific overture, which proved abortive; and a mediation offered to the British government, by the emperor of Russia, was equally ineffectual.

A history, particularly devoted to the occurrences of this eventful war, must be referred to by the reader, for a regular detail of its numerous naval and military incidents. Though the result of the several expeditions under the American officers who had been bred in the school of the revolutionary war, proved, as had been already evinced in Europe, that the tactics of that period were of too formal and tardy a character to oppose with success the improvements which had arisen out of the French revolution; and though the repeated attempts to gain a firm footing in Canada, eventuated only in a useless expenditure of blood, as far as regarded territorial aggrandizement on the part of the United States; yet in one point of view, these rencounters were not without their benefit, as they afforded an opportunity for the young officers of the newly formed army to gain for themselves, and what is of more importance, for their country, a high degree of military honour. Without in this place making any comments upon their comparative merit, or attempting to introduce the names of the subaltern officers who fearlessly shed their blood on the northern frontiers, we think it our duty to introduce into these pages, as the most distinguished leaders of the American armies in that quarter, generals Harrison, Pike, Scott, Brown, Macomb, Miller, Porter, Ripley and Boyd; and also colonels Johnson, Croghan, Fenwick and Forsythe.

1814. To a large majority, however, of the people of the United States, the operations on the Atlantic frontier were of yet more immediate importance. The damage sustained by the proprietors of plantations in the Chesapeake, and on the islands situated in front of the coast of Georgia, was great. The disastrous result of the battle of Bladensburg, on the 24th of August, in which General Winder displayed a signal deficiency of military foresight and resource; and the consequent destruction of the capitol and other public buildings at Washington, by the British under the command of General Ross, were subjects of deep national regret; and the alarm felt, and not without sufficient reason, by the inhabitants of Baltimore, lest their city might be entered, and perhaps plundered and destroyed, by a British fleet and army, could have been allayed only by the gallantry with which, in the month of September, the enemy's troops were met on the water's edge, at North Point, in which engagement General Ross received a mortal wound, and the firmness displayed by the defenders of Fort M'Henry, under Major Armistead, who successfully withstood a furious bombardment by the British fleet during twenty-five hours, and finally compelled the assailants to withdraw.

In the beginning of the year, a British flag of truce had arrived at Annapolis, with despatches for the American government; announcing the expulsion of Napoleon's armies from Spain, his signal defeat about the same period at Leipsic, and that, notwithstanding the rejection of the Russian mediation, the prince-regent of England was willing to enter upon direct negotiations of peace. The president having frankly acceded to the proposal, it was agreed that commissioners should assemble at Ghent. Henry Clay and Jonathan Russel were appointed on the part of the United States, to proceed to Europe, and with John Quincy Adams, James A. Bayard, and Albert Gallatin—diplomatists already there—to commence the pleasing business of conciliation. It required the brilliant victory on lake Champlain, and the equally splendid defence of Plattsburg, on the 11th of September, to remove the unfavourable impression made on those negotiations by the unfortunate surrender of the capital to the British army. But it might reasonably have been supposed that the war would before this period have ceased. Sufficient evidence had been offered to the enemy that no serious impression could be made upon the United States: the pacification of Europe had withdrawn the immediate causes of dispute, and the American commissioners had been instructed to allow the subject of impressment to remain unsettled. But the English government, not equally desirous of peace, proposed as a *sine qua non*, a most insulting relinquishment of this ground of controversy,—a surrender of a large portion of the American territory, and the total abandonment of the coast along the lakes.

Early in September it became known that the enemy were preparing to make a formidable invasion of Louisiana. The majority of the planters there, at least, of French extraction, had felt little interest in the war: the militia, therefore, were scarcely organized, instead of being disciplined and armed. But the chief safety of the inhabitants was in the nature of their country. It was exceedingly difficult of access by sea. In front was a shallow coast, and the principal entrance was a river; which, after crossing the bar, is narrow, deep and rapid, and of a course so winding as to render it easily susceptible of being fortified. On the west are impassable swamps; and on the east the low, marshy coast can be approached only through a shallow lake. Gun-boats, the most appropriate means of annoyance, had, notwithstanding, been neglected. As regarded men, arms, and military works, Louisiana was in a most defenceless situation. Happily for New Orleans, the commander of the district, General Jackson, arrived there on the 2d of December, from Mobile; to which place he had returned, after performing an important military service at Pensacola, and at an earlier period of the war rendering himself conspicuous by the almost total annihilation of the Creek Indians. His presence was instantly felt in the confidence which it inspired, and in the unanimity with which the people seconded his prompt arrangements.

Three days had not elapsed after the arrival of General Jackson, when intelligence was received that the British fleet, consisting of at least sixty sail, was off the coast. Guided by some traitors, the van of the invading army, on the 22d of December, was enabled to penetrate the country through a secret passage, called the Bayou Bienvenu, and for a moment surprise the American guard; but the assailants were quickly repulsed, and General Jackson lost no time in fortifying his post for the protection of the city. This was effected by a simple breast-work, from the Mississippi to the swamp, with a wet ditch in front; cotton bales of a square form being used as the cheeks of the embrasures. Meanwhile the British commander in chief having landed the main body of his army, on the 28th of December, made an unsuccessful attempt to drive the American general from his entrenchments.

1815. January 1st, another unsuccessful attempt was made upon the American lines. On the 4th, General Jackson received an increase of 2500 militia from Kentucky, under generals Thomas and Adair; and on the 6th, the British were reinforced by the arrival of General Lambert. Their whole number was now 14,000. General Jackson commanded about 6000. The lines on the right bank were intrusted to General Morgan, with the Louisiana and detachments of New Orleans and Kentucky militia. The works on the left bank, covering the main body, were occupied by General Jackson himself, with the Tennessee forces, under generals Coffee and Carroll; also a part of the Kentucky and New Orleans militia; the 7th and 44th regiments of United States infantry, with corps of active sailors and marines.

Early in the morning of the 8th of January, the British columns moved forward simultaneously against the right and left of the American batteries. The American artillery opened a tremendous fire at the distance of 900 yards, and mowed them down with terrible slaughter: at length they came in reach of the American small arms, when there was exhibited on the side of the assailants rather an extensive scene of carnage, than a battle in which one party was enabled to return with something like an equivalent effect the shot poured against them by the other. All the efforts of the British officers succeeded only in leading their veteran soldiers to destruction: the men shrunk from a contest in which they saw nothing but immediate slaughter; the columns at length broke, and retreated in confusion. The loss of the British army on this memorable day was 700 killed, 1400 wounded, and 500 captured. That of the Americans on the left bank of the Mississippi, was no more than six killed and nine wounded: on both banks it was thirteen killed, thirty-nine wounded and nineteen missing. The invaders had to regret the death of many experienced and gallant officers. General Packenham fell early in the engagement; and general Keane received a mortal wound.

This is the last military subject, in what may be termed the Three Years War, material to be noticed. The defeat of the British before Plattsburg having given a new turn to the negotiation, a treaty of peace was signed at Ghent, on the 24th of December 1814, ratified by the prince regent of England, on the 28th, and by the president of the United States, with the approbation of the senate, on the last day of February 1815. Both governments agreed to restore their respective conquests, to appoint commissioners for settling disputed boundaries, and pledged themselves to use their utmost endeavours towards accomplishing the entire abolition of the slave trade; but no allusion was made to the causes of the war. This contest, at the same time that it elevated the military and naval character of the American nation, increased the public debt one hundred millions of dollars, and made the whole arrears about one hundred and fifty millions.

Peace having been now restored with England, the establishment of the regular army was fixed at ten thousand men. The naval power, as regarded the larger vessels, was not diminished; but on the contrary, was allowed gradually to be increased. On the Atlantic frontier, there were now afloat one ship of 74 guns, seven frigates, nine sloops of war, and fourteen schooners: on the lakes were twenty-nine vessels, carrying 360 guns; making the whole naval force, including gun-boats, 274 vessels, with 1500 guns.

March 3d, war was declared against Algiers. On the 30th of June, a treaty of peace and amity was signed in the city of Algiers; the negotiators on the part of the United States being commodore Decatur and William Shaler; and on the part of Algiers, the dey Omar Pacha. This treaty was ratified by the United States government, on the 26th of December.

1816. April 10th, the second bank of the United States was established by Congress, to continue twenty-one years from the first of July; the capital to be thirty-five millions of dollars.

September 4th, a treaty of commerce between the United States and Sweden was signed at Stockholm.

December 11th, Indiana was admitted into the Union as a state.

1817. One of the most important subjects that in this year occupied the attention of congress was a revision of the duties on goods imported. In forming the new tariff, a judicious attention was given to protect domestic manufactures, without, at the same time, injuring the national revenue by the consequent decrease of the quantity imported, or lessening, by over-indulgence, the industry and economy requisite tc their full success. The double war imposts were with few exceptions reduced; but a large increase was made to the duties upon some fabrics, particularly cotton cloths of a coarse description, especially when imported from the East Indies; where these articles are manufactured by persons contented with daily wages not exceeding a few cents, and from a material not grown in the United States.

March 4th, James Madison, having filled the office of president for a second term of four years, was succeeded by James Monroe; and the newly elected vice-president was Daniel D. Tompkins, of New York.

December 10th, Mississippi admitted into the Union as a state.

1818. October 20th, convention of London between the United States and Great Britain, respecting fisheries and boundaries; negotiators on the part of the United States, Albert Gallatin and Richard Rush, and on the part of Great Britain, Frederick J. Robinson and Henry Goulbourn. The ratifications were exchanged at Washington on the 30th of June 1819. By the provisions of this convention, the differences under the first article of the treaty of Ghent, are referred to a power friendly to the contracting parties.

December 4th, Illinois admitted as a state.

1819. A negotiation, commenced with Spain for the remainder of that portion of her territory named Florida, which had been interrupted by the temporary overthrow of the old Spanish dynasty by Napoleon, was, on the return of Ferdinand VII. to Madrid, renewed. That region was at length assigned to the United States. A treaty was concluded at Washington, on the 22d of February, which, after many vexatious delays on the part of Spain, was ratified by Ferdinand on the 24th of October, in the succeeding year, approved by the senate of the United States on the 19th, and by the president on the 22d of February 1821. Five millions of dollars were named as the price of Florida. This sum was not, however, to be paid to Spain. It was afterwards apportioned amongst those American citizens whose property was illegally seized in Spanish ports, when under the uncontrollable influence of France. Florida is particularly desirable, from its placing the southern boundary of the United States on the gulf of Mexico; and consequently removing the disagreeable jealousies which had frequently irritated the feelings of the two nations, caused by the occupation of Amelia Island and other places by disorderly troops, under commissions from the South American republics; as well as by the inroads of the Seminole and other nations, when stimulated either by their own chiefs, or foreign white people who had visited them for trade: and the treaty designates the boundary on the side of Mexico (as delineated in the map of the United States by Melish), which had been undefined in the cession of Florida. The negotiator on the part of the United States, was John Quincy Adams; on the part of Spain, Don Louis de Onis.

December 14th, Alabama admitted as a state.

1820. March 3d, act of congress passed by which Maine was admitted into the Union as a state on the 15th of that month.

March 6th, congress passed an act authorising the people of Missouri to form a constitution and state government;—by the 8th section of this act, slavery is forever prohibited in all the territory ceded by France to the United States under the name of Louisiana, which lies north of 36° 30′ north latitude, not included in the contemplated state.

1821. March 2d, congress passed a resolution for the admission of Missouri as a state so soon as the legislature thereof should declare its assent to certain conditions therein expressed, which having been complied with, the president of the United States announced the fact by proclamation on the 10th of August, when Missouri was admitted as the 24th state of the federal Union.

July 7th, Florida was delivered to the United States.

1822. Soon after the accession of Mr. Monroe to the presidential chair, in 1817, he commissioned Messrs Bayard, Graham, and Forbes, with instructions to visit the southern republics, and express to them the kind feelings of their brethren of the north; and also to obtain information respecting their military force, their strength and resources, their moral and political condition, and the probability of their ultimate success. These commissioners were cordially received, and assisted in their researches. Their report placed the question of their final emancipation beyond a doubt: but the view given by the commissioners of their state of society, was not so favourable, and rendered the question of their capacity for self-government, on the principles of republican freedom, extremely doubtful. At what period they were to be admitted into the family of nations as independent states; and when this could be done, without departing from a neutral course with regard to Spain; were very delicate questions. On this subject, the feelings of the people and of congress, were much in advance of the executive. In January 1818, a motion was ineffectually made in the house of representatives, to introduce into an appropriation bill, a sum for the support of a minister at Buenos Ayres, as soon as the president should deem it expedient to appoint one. A few years afterwards the subject was resumed, under circumstances more favourable to the recognition of the infant republics. On the 30th of January 1822, the house of representatives passed a resolution, requesting the president to communicate to them such information as he possessed in relation to the political state of South America; and that officer having complied with the requisition, and recommended that their independence should be acknowledged, the independence of Colombia, Mexico, and Peru, was accordingly recognized, on the 19th of March, with only one dissenting voice, and an appropriation made to establish with them a diplomatic intercourse.

June 24th, a convention of navigation and commerce was signed at Washington, between France and the United States; the negotiator on the part of France being Hyde de Neuville, and on that of the United States, John Quincy Adams. It was ratified on the 12th of February 1823.

July 12th, convention of St. Petersburg, between the United States and Great Britain: negotiators on the part of Russia as mediator, Count Nesselrode and Capo d'Istrias; on the part of the United States, Henry Middleton; and on the part of Great Britain, Charles Bagot. The provisions of this treaty regarded the just meaning of the first article of the treaty of Ghent, in relation to an indemnification for slaves taken from the United States during the last war with Great Britain. Ratifications were exchanged on the 10th of January 1823.

1823. January 27th, ministers plenipotentiary are appointed by the United States to the new republics of South America.

A system of piracy not less atrocious than alarming, arose out of the war between Spain and the South American republics. In the early stage of the contest, those provinces having little shipping of their own, granted commissions for privateering against the commerce of Spain, to any foreigner that applied. A large number of vessels were fitted out in the ports of the United States and in other places; commissions were taken from the republics of the south; and a predatory war was carried on against the ships of Spain. Privateering soon degenerated into piracy. Those who had plundered the vessels of Spain, under a Buenos Ayrean commission, readily engaged in the same enterprise against the vessels of all nations, without any commission. Desperate gangs of this description, of various nations and of all colours, infested the American seas, from the year 1818 to 1823, to so great an extent, as to render the navigation extremely perilous; their robberies being often accompanied with the most cold-blooded and barbarous murder. Their principal haunts were on the northern coast of Cuba, from one hundred to two hundred miles distant from Havana. There they found a region uninhabited, beyond the operations of the Spanish authorities, indented with numerous narrow inlets, affording secure places of retreat for their small vessels, and inaccessible to ships of any considerable size. The pirates had their agents at Havana and Matanzas, to give them notice of the sailing of merchant vessels from those ports; and any that ventured to sail without convoy, almost invariably became their prey. To protect their commerce in these seas, the measure first pursued by the United States was to station there the Congress frigate and eight small vessels. This force in one year captured and destroyed more than twenty piratical vessels on the coast of Cuba; but it did not fully effectuate the purpose, not being provided with the means of following them into their recesses and breaking up their haunts. The proper species of vessels was, however, at length supplied; and an additional force, consisting of the Peacock sloop of war, a steam galliot, and ten small vessels, carrying three or four guns each, was despatched to the West India seas, and with the fleet then on that station, placed under the command of Commodore Porter. Seldom was there undertaken a more harassing service: yet it was performed with such remarkable zeal and success, that at the end of sixty days from the commencement of his operations, the commodore, in his official despatches to the secretary of the navy, was enabled to say, that in the region of Matanzas, the scene of their greatest depredations, there was not a pirate afloat larger than an open boat; and that not a single piratical act had been committed on the coast of Cuba, since he had organized and arranged his forces.

1824. February 25th, a treaty was signed between the United States and Tunis.

April 17th, a convention between the United States and Russia was signed at St. Petersburg; negotiators on the part of the United States, Henry Middleton, and on that of Russia, Count Nesselrode and Pierre de Poletica.

October 3d, a treaty of navigation and commerce was signed at Bogota, in New Granada, between the United States and Colombia; negotiator on the part of the United States, Richard Clough Anderson, and on the part of Colombia, Pedro Gual. It was ratified May 31, 1825.

August 15th, General La Fayette, accompanied by his son, Mr. George Washington La Fayette, arrived in the harbour of New York, on a visit to the United States. His tour eastward as far as Portsmouth; southward, as far as New Orleans; and westward, to St. Louis, in the state of Missouri;

and back to Boston by the way of Louisville, Cincinnati, Pittsburgh, Rochester, Schenectady, Utica, Troy, and Albany; a journey more than 5000 miles, was every where signalized by the same enthusiastic attentions and congratulations. By the revolution in his native country, La Fayette had become comparatively poor; and his visit to the scene of his youthful exploits in the service of the struggling Americans, enabled congress to display the nation's gratitude to their benefactor, by granting him 200,000 dollars in money; besides a township of six miles square, of any of the unappropriated lands which the president should select.

1825. March 4th, John Quincy Adams, of Massachusetts, became president of the United States, and John C. Calhoun, of South Carolina, vice-president.

December 25th, a convention of peace, amity, commerce, and navigation, was signed at Washington, between the United States and the Federation of Central America, finally called Guatimala; negotiators being Henry Clay, on the part of the United States, and Antonio Jose Canas on the part of Central America.

1826. April 26th, treaty of friendship, commerce, and navigation, signed at Washington, between the United States and Denmark; negotiators on the part of the United States, Henry Clay, and on that of Denmark, Peter Pederson. Ratified August 10th.

July 13th, convention of London between Great Britain and the United States, by which the former engaged to pay to the latter $1,204,960, for property carried away contrary to the first article of the treaty of Ghent; negotiators, on the part of the United States, Albert Gallatin; on the part of Great Britain, William Huskisson and Henry U. Addington.

July 4th, having completed fifty years since the declaration of independence, the day was celebrated as a national jubilee. The retrospect was truly cheering and delightful. The annals of the world exhibit no previous example of so rapid a progress in agriculture and commerce, the arts, manufactures, and population. From weakness the states had advanced to strength; from infancy to manhood; from thirteen they had increased in number to twenty-four; from a population of three millions, thinly scattered along the borders of the Atlantic, they had increased to ten millions, spread beyond the banks of the Mississippi to the base of the Rocky Mountains; and, as if to mark the fiftieth anniversary of the nation's birth by events of signal and unprecedented coincidence, Adams and Jefferson, two of the signers of the declaration of independence of the three who were yet permitted to witness their country's happiness and glory, beheld the sun of that joyous day rise, and beheld it for the last time. Mr. Jefferson died at his seat at Monticello, Virginia, at one o'clock in the afternoon of the 4th of July, in his eighty-fourth year; Mr. Adams died at Quincy, Massachusetts, in his ninety-first. They were the only surviving members of the committee appointed to draft the declaration; Mr. Jefferson was himself the composer of that celebrated instrument; they had both been presidents of the United States; they were the most distinguished leaders of their respective political parties; Mr. Jefferson had expressed a strong desire to see the jubilee of American independence; Mr. Adams expressed his patriotic feelings in a sentiment to be used that day at the festive board. The nation mourned their loss. By an order of the president, appropriate funeral honours were rendered at all the military and naval stations, and the officers directed to wear badges of mourning for six months; and in the principal cities and towns, days were set apart for the same purpose, and funeral processions and eulogiums manifested a universal sentiment of national sorrow.

1827. July 4th, treaty of Stockholm, between the United States and Sweden and Norway.

August 6th, the convention of London of the 20th of October 1818, between Great Britain and the United States, then limited to ten years, now continued indefinitely.

December 20th, treaty of Washington, of commerce and navigation, between the United States and the German Hanseatic cities of Luben, Bremen, and Hamburg.

1828. May 1st, treaty of Washington, between the United States and Prussia.

December 12th, treaty of Rio de Janeiro, between the United States and Brazil.

March 4th, Andrew Jackson became president of the United States, and John C. Calhoun continued vice-president.

1829. August 27th, treaty of Washington, between the United States and Austria.

1830. March 28th, treaty of Copenhagen, between the United States and Denmark, providing for the payment by the latter to the former of $650,000, as indemnification for commercial spoliation.

May 7th, treaty of Constantinople, between the United States and Turkey, securing to the former the free navigation of the Black Sea.

1831. April 5th, treaty of commerce between the United States and Mexico, ratified by the Mexican government.

July 4th, convention between the United States and France, providing for indemnification to the citizens of the former government for spoliations committed by the latter during the wars of the French revolution.

1832. Treaty of Constantinople of the 7th of May 1830, between the United States and Turkey, ratified by the president, January 4th.

April 5th, the ratification of the treaty of commerce and navigation, and of limits, between the United States and the republic of Mexico, exchanged by the secretary of state of the former and the charge des affaires of the Mexican United States.

The boundary between the United States and British provinces of New Brunswick and Lower Canada remains unsettled. W. DARBY.*

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* Though this article bears my name, it is proper to inform the reader that all between pages 280 and 289, was supplied by G. W. Smith, Esq. and from page 339 to page 352, by William Grimshaw, Esq. Mr. Smith also made several valuable additions to the data, and removed some errors from my statements. The stock of materials on Roads and Canals, in his possession, contained, in some essential parts of the subject, the most recent information: his emendations have, of course, added much that is valuable to the article.—W. D.

EDUCATION IN THE UNITED STATES.

Among the various topics of interest connected with the history, progress and actual condition of the United States, none deserves a more attentive consideration than that of the means by which the public *mind* is developed and matured.

Whatever *peculiar* interest may be attached to the United States as a nation, must obviously be attributable to other causes than mere local and physical advantages. Whatever hopes may be entertained in regard to the amelioration of man's social condition and political relations, as developed in the western hemisphere, must be founded on the presence and action of causes not operative in the despotic nations of Europe. The acknowledgement, both theoretical and practical, of a few important maxims in politics, and the wide and general diffusion of *intelligence* by all the appropriate means, constitute the main differences between the population of this country and that of several nations in the eastern hemishere. The original individual dispositions of men here are probably much the same as in Europe; and it would be vain to expect, from the mere advantage of local situation, an exemption from the evils which beset the race, whether in their individual or their social capacity, so long as the intelligent principle of the mass of society lies dormant, and those moral energies which prove conservative in all times of difficulty and danger, are permitted to receive but a partial development, or a meager aliment, when brought into action.

It is proposed in the following sketch, after a brief account of the early efforts which were made to promote the cause of intelligence among the first colonists, and a concise statement of the results of those attempts previous to the revolution, to consider the means and the authority by which public provision for general education has been made.

Referring next to the different classes of seminaries and institutions by which education is promoted, we may consider in particular the number and character of each class with its influence on the state of general intelligence.

We shall then present some statements respecting institutions peculiarly appropriated to certain classes or professions of the community; and finally, note the influence of voluntary associations, having for their avowed object the advancement of learning or the promotion of education.

Education, regarded as a great public interest, is necessarily considered in close connexion with the means provided, and the institutions established for the purposes of public *instruction*. Though some affect to draw a broad distinction between these two things, they are in fact so intimately connected, that any reference to a system of public *education*, of which instruction is not the predominant and most important feature, becomes almost ridiculous. It may be added that much of what is called *teaching* is neither instruction nor education, as it neither conveys knowledge nor developes the understanding. Such is all that species of dogmatising which consists in forcing upon the mind general truths without the concomitant, or rather the antecedent examination of the facts on which they are established.

The amount of *public patronage* to seminaries of learning, must not be assumed as the absolute measure of education in any part of the country, and least of all in those states where public schools, academies, and colleges have been longest established. The amount of money paid and the quantity of instruction given in private schools and families, is, in all the states, very considerable; and, though it does not effect all the objects of education, and though it confines the views of youth and limits the number of those parents who take a deep interest in public instruction, yet it serves to bound, in some degree, the inroads of ignorance and error, vice and superstition.

The early colonists of the eastern portion of the Union brought from the parent country some just and admirable ideas of the true basis of liberty, which they endeavoured to establish on the foundation of universal intelligence. One of the first acts of legislation of the colony of Massachusetts Bay, which received its royal charter in 1628, was a law for the education of every child in the colony. This law merely made it obligatory on parents to educate their own children and apprentices; but in 1647 the same colony enacted a law to establish schools for instruction in the common branches of an English education in every *town* containing fifty families; and a school for the higher branches in each town containing one hundred families. The germ of all the common school systems of the United States, may thus be regarded as coeval with the settlement of the country; and the spirit which dictated this admirable provision for universal intelligence (though blended in the minds of the early colonists with much of that puritanical austerity which is equally opposed to nature, reason, and rational religion) is to be commended as the essential principle of free government and of equal rights. A penalty of twenty pounds was affixed to the neglect of this law on the part of any town.

There is a difficulty, if not an utter impossibility, in obtaining authentic information respecting the exact state of the schools erected in early times, in accordance with these laws. They were managed and controlled solely by the little corporations called in the eastern states *towns;* elsewhere known by the designation of *townships*. No regular general report of their condition and operation was rendered, and the government of the colony was not authorised to interfere in their management farther than to grant the remedy for neglect to provide schools, where the law authorised and required such provision. But public opinion appears to have been ever in advance of the requirements of the law; as few, if any penalties were incurred by the towns for remissness in this particular. The colony of Connecticut was early engaged in the cause of universal education; and her system of public common schools has at all times constituted the chief object of care and anxiety. The same provision and the same limitations as to number of families required to oblige a town to support schools, were found as in the older colony of Massachusetts.

But notwithstanding the obvious policy and usefulness of the system of general education, it will require but little reflection to convince us that the greater part of the efforts of a public nature made for the diffusion of education, have been applied to those classes whose moral and intellectual culture least requires the fostering care of government. With the exception of some of the New England states, particularly Massachusetts and Connecticut, little had been done for common schools before the commencement of the present century. In the two states just named, provisions for universal education were, as already stated, among the *first* objects of their pilgrim founders. Their reason for wishing the blessings of knowledge to be widely diffused, are certainly as cogent under the independent as they could have been under the colonial government.

In the first law of Massachusetts, it was provided "that none of them (the colonists) shall suffer so much barbarism in any of their families, as not to endeavour to teach, by themselves or others, their children and apprentices so much learning as may enable them to read the English tongue, *and knowledge of the capital laws.*"

By a reference to the list of colleges given below, it will be seen that up to the time of the revolution in 1776, only eight of those institutions had been formed for a population of three millions. This number it will also be seen is now increased eight fold, for about a quadruple population; and other schools of a higher class have doubtless been multiplied in a proportionate degree.

Harvard college, the oldest in the United States, had, during the ten years immediately preceding the American revolution, about one hundred and seventy students. The other seven colleges did not probably, at that time, average more than half that number each, but the wealthier and more loyal part of the colonists were in the practice of sending their sons to England for education—a practice, which, while it fostered a colonial dependence, withdrew a portion of encouragement from the institutions founded in America.

The constitution of the United States has not confided to congress the superintendence of public instruction, rightly judging, perhaps, that such a power could be best exercised by those who were most immediately concerned in the faithful execution of laws respecting this matter. The bestowment of a portion of the public lands to be held by the several states for purposes of education, is, in fact, an acknowledgement that congress does not possess the power to regulate the details of instruction, at the same time that it indicates a just estimate of the important cause, for the promotion of which the appropriations in question have been made.

The local legislatures of the twenty-four states are therefore the only acknowledged organs for declaring and executing the public will in this particular.

But though the minute arrangements for promoting education, are not under the control of the general government, there is one mode in which it may conduce directly to the advancement of the cause of instruction; and that is, by furnishing, at the time of taking each census, a full account of the number of persons receiving education in every precinct of the country: such statistics are a great desideratum, and could in no manner essentially impede the progress of those employed to make the enumeration.

The different kinds of institutions for education established by public authority, may be reduced to the following classes:

1. Primary or "common" schools.
2. Academies, high schools, or gymnasia.
3. Schools and institutes for practical popular instruction.
4. Colleges and universities.
5. Professional schools.

To which may be added several establishments for the instruction of particular classes, who from certain peculiar circumstances are precluded from a participation in the benefits of the general provisions for instruction. Such are the *deaf* and *dumb*, for whom several flourishing institutions have been erected, and the *blind*, who are likely soon to enjoy such a measure of the blessing of instruction as their unfortunate deprivation will admit.

It will be evident that the cause of education is one on which the American people set a high and a just estimate, when we recollect that the establishment of public seminaries, of all the above descriptions, has never been made to prejudice the right of any individual or company to establish similar institutions on their private account and responsibility; and that no authority and no inquisitorial power whatever can be exercised to limit or abolish that right, but on the contrary numerous establishments of the first respectability have from the earliest times been maintained on that footing. The seminaries of a private kind have, indeed, sometimes far surpassed those which claim public patronage, both in the liberality of their provisions, the ability of their teachers, and the numbers of their pupils. They are useful in giving that free scope to the choice of methods and range of studies which is seldom allowed in those public institutions especially of a higher class, which rest on the basis of chartered privileges. We proceed to give such facts in regard to the *nature and condition of the several classes of institutions* as the imperfect and scattered statistics of the subject will at present admit.

TABLE XLIX.

Tabular view of the condition of the several states in regard to the means of Education.

States.	Number of common Schools.	Students in common Schools.	Annual expenditures for common Schools.	Established funds for the support of Schools.	Sources of the permanent funds.	Means of supporting the common schools now in existence.	Date of the commencement of the system.	No. Academies.	No. of Colleges.
ine	2600	100,000	$150,000			Tax on each person of 40 cents per annum.		29	2
Hampshire				$ 64,000	Raised by ½ per cent on banks. $90,000 annually raised.	Fund and taxation.		30	1
rmont	2400	75,000	100,000	30,000	6 per cent on bank profits.	Tax of 3 per cent on the valuation list for state taxes.	1827	35	2
ssachusetts	no returns.				None.	Taxes levied by towns and expended under their own authority.	1629	56	3
ode Island	650	36,000			$10,000 annually appropriated by state.			10	1
nnecticut	1500	82,500	84,499	1,882,261	Sale of reserved lands in the state of Ohio.	Proceeds of school fund.	1655		3
w York	8900	480,257	957,680	1,661,081	Sale of lands, &c.	School fund, taxes, and voluntary contributions.	1795	50	4
w Jersey				250,000	½ per ct. on bank stocks.	$20,000 annually out of school fund.			2
nnsylvania					Sale of public lands.	County taxes for the education of the poor.	1809	56	10
laware				170,000		½ from funds, ½ from taxes.			
ryland				75,000	Appropriation and ⅕ per cent on bank stocks, and profits on turnpike.	Proceeds of fund and direct tax.	1816	10	4
of Columbia									2
rginia		11,799		1,510,689	Escheats, confiscations and derelict property.	$45,000 per annum from fund for schools. $15,000 to university.	1809		4
rth Carolina				70,000	do.		1825		1
uth Carolina	840	9,036	39,716			Annual appropriation by legislature of $40,000, with $15,500 to the college.			2
orgia	375	23,250		500,000	$250,000 granted and 2000 acres of land to each Co.		1792	80	1
bama				304,651	25,000 acres, and sale of appropriated land granted by congress.		1819	24	2
ssissippi				28,000	Escheats, confiscations, &c. Grants by congress of a certain part of public lands.	Escheats, confiscations, forfeitures, &c.			1
uisiana					Do.	$40,000 annually appropriated by legislative grant of $2 62½ to each voter.	1827		2
nnessee					Do.	¾ of a mill on a dollar of the taxable property except slaves.	1831		3
ntucky		10,945		150,000	Do.				6
io					$\frac{1}{36}$ part of the public lands set apart for common schools.	¾ of a mill on a dollar of the valuation list for school purposes; act passed March 1831.	1825		5
iana					Public lands by congress.				1
nois	550	12,290			998,374 acres of land have been appropriated.				1
ssouri					Public lands granted by congress.			9	2

From the above table it will be seen that in two of the New England states, Massachusetts and Connecticut, laws for the establishment of common schools, where all classes of society might together receive the elements of an English education, were enacted at a period far anterior to the revolution. The system of general education in Massachusetts was commenced prior to the establishment of any college in the country. So far, therefore, as precedent and prescription have authority, the common school system ought to be regarded as the *national system*, and cherished accordingly. This appears to be, at present, the general feeling throughout the community, and it is probable that no considerable legislative action in favour of education will hereafter take place, which does not involve the acknowledgement of this as the basis, and admit the *right to be educated* as a preliminary to the obligation to submit to the authority of law or to bear a part in the national defence.

In several of the southern and in some of the middle states, the public provision for instruction in common schools has reference solely to *the poor.* This peculiarity has tended little to render the plan either acceptable or useful. The feeling of degradation connected with the acceptance of a boon, is, in many instances, strong enough to deter the people altogether from receiving the proffered instruction. And though panegyric has been exhausted and efforts multiplied to force this system into popularity, yet they have been so far from succeeding, that the people often prefer total ignorance to knowledge *on such terms;* and the poorer classes of population in the states where it exists, are accordingly among the worst instructed poor in the Union—perhaps in the world.

It may be inferred from recent movements among the people themselves, as well as among their representatives, that the estimate in which eleemosynary instruction is held, cannot be very high. The former claim as a *right*, and as an indispensable incident to their condition as freemen, the equal enjoyment of at least elementary instruction, since this is the only means of enabling them to comply with the duties and obligations imposed by the constitutions and laws under which they live.

Plain sense and some experience have concurred to justify the remark of an able advocate* of public education, which we take the liberty to transcribe.

"Only allow the rich (no matter under what pretext, whether of philanthropy, or patriotism, or interest) to prescribe the education of the poor, and they prescribe their condition and relative importance. If any thing be anti-republican, it certainly is so, directly or indirectly, to maintain that although a hundred dollars a year is not too much to expend for the mental improvement of the son of the wealthy merchant, lawyer, and physician, a two dollar education is quite sufficient for the children of the poor; or in other words, the mass of our fellow citizens."

The system of common schools has in some instances been so modified as to include a department exclusively appropriated to children under seven years of age. They are sometimes called *primary* in contradistinction to the remaining portion of the common schools; and sometimes *infant schools*—the latter designation, as well as the general features of the system itself, being derived from the establishment of Mr. Owen, at New Lanark, where the first infant school is said to have been put in operation.

Wherever the system of common schools has been established on a solid basis, and managed *by the people* on just and liberal principles, it has not failed to display the most gratifying results on the character and habits of the people. It has diminished crime, promoted temperance, quickened industry, abated pauperism, substituted mental for animal pleasures, implanted a general desire for useful information, and rendered the spirit of liberty and of patriotism a living and energetic *principle* of action. It has made the enormity of slavery more apparent to the general mind, and has followed close in the rear of that odious system, wherever the force of public sentiment has caused its abolition. Female character is observed to possess more universal esteem wherever the system of universal education has been adopted. Both sexes are alike the subjects of its salutary and sustaining influences, and mutually aid each other to maintain the virtue and intelligence of the social system.

2. *Academies, high schools, gymnasia.*—The term *academy*, as applied to a species of schools intermediate between the colleges and the common or English schools, has long been known as a denomination of a valuable class of seminaries which abound in all the United States, and which have probably been instrumental in sustaining the general intelligence of the population in a degree quite equal to that of the colleges, and inferior only to that of common schools.

The advantage possessed by these institutions is, that not being fettered by any exclusive course of studies and operations, they are enabled to extend the range of studies and adopt such improvements in instruction as the spirit of the age shall from time to time render expedient or useful; they can provide practical instruction precisely adapted to the situation and circumstances of the community in which they are established; they can dispense with the waste of time incident to the study of branches that can never be rendered available, and can substitute those which are directly connected with the duties and occupations of life; they can afford to youth in moderate circumstances the means of becoming adequately qualified for any of the stations and relations of general society, and they are often made to furnish a portion of classical and other instruction entirely sufficient for entering on any of the learned professions. Many highly distinguished members of all those professions have received no other education than that furnished by an academy, high school, or gymnasium.

The mode of sustaining the academies is generally that of uniting a small fund sufficient to provide buildings and furniture, and to pay some portion of the wages of the teachers, with a moderate quarterly charge upon the students. The funds of some academies amount to fifty or sixty, and of a few to nearly one hundred thousand dollars. Their concerns are chiefly managed by trustees, the mode of whose appointment is various according to the directions of their respective charters. The *gymnasia* which have been erected in the United States have been mostly the results of individual enterprize, and constructed on the plan of similar establishments in Germany.* The high schools derive their name from an establishment long known under the title of the High School of Edinburgh. They generally embrace a course of classical, mathematical and English education, with the study of modern languages and several departments of natural science. Like their prototype, they have in many instances availed themselves of the effectual aid of monitorial instruction and with the best results, employing it not as a *substitute* but as an *auxiliary* for the regular teacher. Prejudice and jealousy have sometimes been found combined to counteract the diffusive usefulness of these establishments, but it is believed their number has not been thereby essentially diminished. The education of females on this plan has been particularly successful.

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* Mr. Peers, of Kentucky.

3. *Popular Education.*—It would be unjust to omit a notice of the very meritorious exertions which in many parts of the United States have assumed the form of systematic efforts for the purposes of *popular instruction.* In the principal cities and in many of the larger towns and villages the business of giving instruction of this kind is carried on in regularly organized societies. The method of teaching, which is chiefly by lectures, resembles essentially that employed by the mechanics' institutions and other popular societies of Europe. Among us these establishments are known by the names of "Lyceums,"—"Societies for the promotion of useful knowledge,"—"Mechanics' Institutions,"—"Franklin Institutions," &c., and their influence wherever situated has been highly useful in exciting a spirit of inquiry, in rousing an attention to the great topics which engage the minds of men and render them sensible of the dignity and value of a cultivated intellect, and in substituting a fountain of innocent and rational gratification for the idle gossip or the low dissipation into which the mass of an ignorant community is ever liable to fall.

There are, it is believed not less than one thousand of these institutions scattered throughout the whole extent of the United States. But few of them have received any direct aid from legislation. They are mostly voluntary associations for mutual aid and encouragement in the prosecution of a common interest. Besides lectures on the more popular departments of science, they generally embrace discussions, oral or written, on topics interesting for their practical bearing, but they very judiciously avoid the profitless questions of theology, and party politics. It is not the least of the recommendations of these useful societies, that they offer to teachers and others concerned in the business of education, an opportunity to enlarge the sphere of their usefulness and to benefit the cause of instruction by the discussion of methods and the development of principles, pertaining to youthful education.

The establishment of several periodical works of a highly useful character is due to the exertions of these popular institutions.

It is worthy of remark in this connexion, that the first Journal of Education† in the English language, was commenced in the United States and was for several years conducted with a spirit and liberality of tone which deserve high commendation. In the mean time the British press has begun to labour in the cause, and a quarterly periodical of most respectable promise has recently been sent forth. Other efforts to the same purpose have likewise been made in America, but their influence has been less direct and beneficial, owing in some instances to the want of due qualifications in their conductors and in others to the partial and sectarian tone which they have assumed.

Among the objects of practical instruction which the friends of education have desired to embrace in their plans of improvement, is that of agriculture. And they have anxiously sought for some modification of the foreign establishments which might be adapted to the genius and feelings of America. The establishment of Hofwyl in Switzerland has features wholly repugnant to the republican character, and which must therefore be abandoned before any considerable success will attend these efforts. The *manual labour schools*, of which several have been erected in the United States, have too frequently partaken of the theological and sectarian character to admit of general public patronage.

4. *Colleges.*—The following schedule exhibits a view of the states of the union in regard to collegiate institutions, including the names, places and dates of the several establishments, the number of instructors attached to each, the number of persons who have received their education at each college since its foundation, the number of students at each in 1830—31 as far as could be ascertained, the number of volumes in the libraries of the respective colleges or in those of societies connected with the same, the number of weeks per annum during which instruction is given; the ratio of population to the number of students at college in each state, and the average number of students assigned to one teacher in each college.

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* Among the earliest of this class of schools may be mentioned that at Round Hill, Northampton, Mass.

† "The American Journal of Education," edited by William Russel. Boston, January 1, 1826.

TABLE L.

Tabular view of Colleges in the United States in 1830—1.

States.	Names of Colleges.	Places.	Date of foundation.	Instructors.	Alumni.	Students.	Vols. in College Library.	Vols. in Studs. Libraries.	No. of weeks instruct. per an.	No. of Pupils to each Instruct.	Ratio of population to Studs. in College in each state.
Maine	Bowdoin	Brunswick	1794	7	392	137	8,000	4,300	39	19	$\frac{399.562}{182}=2140:1$
	Waterville	Waterville	1820	5	60	45	1,800	600	39	9	
New Hampshire	Dartmouth	Hanover	1770	9	2250	153	6,000	8,000	37	17	$\frac{269.533}{153}=1761:7$
Vermont	Univ. of Vermont	Burlington	1791	4	182	36	1,000	500	40	9	$\frac{280.679}{135}=2079:1$
	Middlebury	Middlebury	1800	5	509	99	1,846	2,322	39	20	
Massachusetts	Harvard Univ.	Cambridge	1638	24	5621	236	35,000	4,500	40	10	$\frac{610.014}{439}=1366:1$
	Williams	Williamstown	1793	7	721	115	2,550	2,000	34	16	
	Amherst	Amherst	1821	10	208	188	2,380	4,515	39	19	
Rhode Island	Brown Univ.	Providence	1764	6	1182	95	6,100	6,000	39	16	$\frac{97.210}{95}=1023:1$
Connecticut	Yale	New Haven	1700	15	4428	346	8,500	9,000	40	23	$\frac{297.711}{416}=715:1$
	Washington	Hartford	1826	9	25	70	5,000	1,200	41	8	
	Wesleyan Univ.	Middletown	1831	5		50				10	
New York	Columbia	New York City	1754	6	880	124	8,000	6,000	43	21	$\frac{1.913.508}{437}=4388:1$
	Union	Schenectady	1795	10	1373	205	5,150	8,450	39	20	
	Hamilton	Clinton	1812	7	189	77	2,900	3,000	39	11	
	Geneva	Geneva	1823	6	15	31	500	900	42	5	
	New York Univ.	New York	1831								
New Jersey	Col. of N. Jersey	Princeton	1746	10	1930	105	8,000	4,000	40	10	$\frac{320.779}{175}=1833:1$
	Rutgers	New Brunswick	1770	5		70			43	14	
Pennsylvania	Univ. of Penn.	Philadelphia	1755	6		126			40	21	$\frac{1.347.672}{490}=2750:1$
	Dickinson	Carlisle	1783	4		21	2,000	5,000	42	5	
	Franklin	Lancaster	1787								
	Jefferson	Canonsburg	1802	7	341	167	700	1,800	43	24	
	Washington	Washington	1806	4	143	47	400	525	43	12	
	Alleghany	Meadville	1815	3	9	6	8,000			2	
	Western Univ.	Alleghany Town	1820	4	45	53		50	43	13	
	La Fayette	Easton	1826								
	Madison	Union Town	1827	5	1	70			43	14	
	Girard	Penn Township	1831							8	
Maryland	St. Mary's	Baltimore	1799	18		147	10,000		45	15	$\frac{455.913}{353}=1266:1$
	St. John's	Annapolis	1784	5	636	76	2,100				
	Univ. of Md.	Baltimore	1812	11					41	5	
	Mt. St. Mary's	New Emmettsburg	1830	25	12	130	7,000		45	12	
D. of Columbia	Columbian	Washington City	1821	4		50	4,000		45	7	$\frac{39.858}{190}=209:1$
	Georgetown	Georgetown	1799	19		140	7,000			8	
Virginia	William and Mary	Williamsburg	1693	7		60	3,600	600	36	9	$\frac{1.211.272}{267}=4536:1$
	Hampden Sidney	Prince Edward Co.	1774	6		54			43		
	Washington	Lexington	1812		380	23	700	1,500	44	14	
	Univ. of Virginia	Charlottesville	1819	9	538	130	800		46		
North Carolina	Univ. of N. Car.	Chapel Hill	1791	9	434	69	1,800	3,000	42	7	$\frac{738.470}{69}=10702:1$
South Carolina	Charleston	Charleston	1785	7	27	61	3,000	1,000	44	9	$\frac{581.488}{172}=3386:1$
	College of S. Car.	Columbia	1801	9	490	111	2,000		38	12	
Georgia	Univ. of Georgia	Athens	1785	7	256	95	2,000	2,250	41	13	$\frac{516.567}{95}=5427:1$
Alabama	Alabama Univ.	Tuscaloosa	1820	6		65	1,000		42	11	$\frac{308.997}{95}=4737:1$
	Lagrange	Franklin Co.	1830								
Mississippi	Jefferson	Washington	1802	10		160				16	$\frac{136.806}{160}=855:1$
Louisiana	Louisiana	Jackson									$\frac{215.575}{\text{uncer.}}$
	New Orleans	New Orleans									

TABLE L. *continued.*

States.	Names of Colleges.	Places.	Date of foundation.	Instructors.	Alumni.	Students.	Vols. in College Libraries.	Vols. in Studs. Libraries.	No. of weeks instruct. per an.	No. of Pupils to each Instruct	Ratio of population to Studs. in College in each state.
Tennessee	Greenville	Greenville	1794			32	3,500		42	24	$\frac{684.822}{148}=4637:1$
	Cumberland	Nashville	1806	4	93	95	2,500	750	41	10	
	East Tennessee	Knoxville		2		21	340	200	44		
Kentucky	Transylvania	Lexington	1798	6		143	2,350	15,00	41	24	$\frac{688.844}{494}=1392:1$
	St. Joseph's	Bardstown	1819	15	37	150	1,300			10	
	Centre	Danville	1822	4	19	66	1,258	108	40	16	
	Augusta	Augusta	1823	7		98	1,500	550	40	14	
	Cumberland	Princeton	1825	3	13	57	1,000	600	45	19	
	Georgetown	Georgetown	1830			35					
Ohio	Univ. of Ohio	Athens	1802	4	60	57	1,000	1,000	42	14	$\frac{937.679}{394}=3301:1$
	Miami Univ.	Oxford	1824	11	57	192	1,000	1,200	42	7	
	Western Reserve	Hudson	1826	4		36	1,000	100	45	9	
	Franklin	New Athens	1824	3		40				13	
	Kenyon	Gambier	1828	4		80				20	
Indiana	Indiana	Bloomington	1827	3	4	51	182	50	43	13	$\frac{341.582}{51}=6697:1$
Illinois	Illinois	Jacksonville	1830	3		35	600			11	$\frac{157.575}{35}=4502:1$
Missouri	St. Louis	St. Louis	1829	6		125	1,200			21	$\frac{140.074}{125}=1120:1$
		Bois Brulé Bottom									
	Total, Colleges, 65										

By an examination of the foregoing schedule it will be seen, 1st, That in 55 colleges there is an aggregate of *four hundred and five* instructors, or an average of about 7½ to each college.

2. That in fifty-six colleges of which the numbers of students are given, the aggregate is 5293, making an average number of 94½ to each college, and that of the whole number, only nineteen have above 100 students each.

3. That if we suppose one-fourth of the above number, viz. 1322 students to leave college annually, then will each instructor have prepared on an average 3¼ young men each year for the duties of life, or for entering on the studies of his profession.

4. By a similar comparison of the whole number of teachers with the whole number of students, it will be found that each instructor has on an average $\frac{5293}{405}$ or a small fraction over 13 scholars committed to his charge.

5. That for the use of 47 colleges there have been supplied 197,656 volumes of books.

6. That in the students' libraries of 35 colleges, the aggregate number of volumes is 87,170. (In several colleges not particularly specified there are known to be considerable libraries belonging both to the colleges and to the students.)

7. That the time allotted to instruction in 47 colleges is on an average 41½ weeks per annum, leaving 10½ weeks for vacations.

8. Supposing the population of the United States to be 13 millions, and the number of graduates 1300, which is probably above the truth, then will the ratio of those who annually graduate to the whole population be $\frac{1}{10000}$th. This will prove that all the provision of this sort made for public instruction has hitherto been limited to a comparatively small number, and where this kind of education is exclusively relied on, must prove extremely fallacious as a means of maintaining the standard of public intelligence.

Many of these institutions, it will be perceived, are in their infancy; and others are struggling against various adverse circumstances which it will require many years to surmount. Some of them have doubtless been erected in anticipation of the actual wants of the districts of country in which they are placed, and seem to have been established by certain sects and denominations of persons rather to preoccupy the ground and to serve as *caveats* against others, than with any view to the public necessities. This circumstance has caused the terms *college* and *university* to be extremely vague in their application, as the establishments which they denote are almost as different from each other in means and appliances, as some of their number are from the humblest common schools. Twenty of the colleges in the above list have less than sixty scholars each. Many academies and high schools in the country have more than double that number, and the courses of study in the latter are, to all useful purposes, as extensive as those of many of the colleges. In the fifty academies in the state of New York, there were in 1829 on an average about seventy students each.

It is a fact somewhat remarkable, that in a country where no hierarchal rule is, or can be established, the authority of controlling education, especially in its higher departments, should be almost exclusively entrusted to the hands of clergymen. Among the names of colleges in the above list it is believed that not more than six can be enumerated of which the presiding officer is not of that profession. It is true the exceptions* are eminent ones, and, though recently made, will be likely to induce imitations in other quarters. Another fact not less worthy of remark in this connexion is, that even in the selection of clergymen to fill the places of heads of colleges and teachers in the various departments, no particular regard has been paid to the previous habits of the individual. A man who has gained perhaps a little notoriety by his declamations, or his boldness, or his uncharitable denunciations, is deemed thereby qualified to prepare the youth of the country for their civil and social duties, and among others for that of mutual kindness and forbearance towards their brethren of all denominations. This forbearance is unquestionably among the first obligations of an American citizen, since the spirit of the national and local compacts is violated by every instance of a departure from the charity it inculcates.

5. *Professional Schools*, though not essentially connected with the purposes of general instruction, are, to a certain extent, important in a public view. They serve to sustain in their *alumni* a certain sense of the dignity of the vocation to which they have applied themselves, and to maintain an "esprit du corps" (whether for good or for ill) among those who have derived their motives as well as their principles of action from a common source.

In comparing the lists of professional schools for 1831, we perceive that the United States contain twenty-seven of Theology, seventeen of Medicine, and nine of Law. Thus, Theology has erected for itself nearly twice as many establishments as Medicine, and three times as many as the Law. The following tables†, and the appended remarks, contain all that we deem it necessary to add in regard to this part of our subject.

TABLE LI.

A List of Theological Seminaries in the United States, with the denominations by which they are upheld; the places in which they are established; the date of their commencement; number of Clergymen they have sent forth; number of Students in 1831*; the number of Volumes in their Libraries, and the number of Professors attached to each.*

Denominations.	Name.	Place.	Date.	No. educated.	Students in 1831.	Vols. in Library.	No. of Professors.	Remarks.
Presbyterian and "orthodox" Congregationalist.	Bangor Theo. Seminary.	Bangor, Me.	1816	50	14	1,200		Since suspended.
	Theo. Seminary.	Andover, Mass.	1808	514	139	10,000	4	
	Theo. Dept. Yale College.	New Haven, Conn.	1822	70	48		3	
	Theo. Seminary of Auburn.	Auburn‘ N. Y.	1821	157	51	4,000	3	
	Theo. Sem. Presb. Church.	Princeton, N. J.	1812	537	92	6,000	3	
	Western Theo. Seminary.	Alleghany T. Penn.	1828		22	3,964	2	
	Union Theo. Seminary.	Prince Ed. Co. Va.	1824	30	42	3,000	3	
	South Theo. Seminary.	Columbia, S. C.	1829		9		2	
	South-west Theo. Seminary.	Maryville, Tenn.	1821	41	22	5,500	3	
	Lane Seminary.	Cincinnati, Ohio.	1829					
Roman Catholic.	St. Mary's.	Baltimore, Md.						
	Mt. St. Mary's.	Emmettsburg, Md.						
	———	Charleston, S. C.						
	———	Bardstown, Ky.						
	———	Washington Co. Ky.						
	———	Perry Co. Missouri.			25			
Episcopal.	Mass. Epis. Theo. School.	Cambridge, Miss.	1831				4	
	Theo. School of Epis. Church.	New York.	1819	134	28	3,600	4	
	Epis. Theo. School of Va.	Fairfax Co. Va.			19	1,500	3	

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* The exceptions referred to, are Cambridge, Columbia (N. Y.), University of Virginia, and South Carolina College; to which may be added the new *Girard College*, in which the absurd practice of setting those to control teachers who have no knowledge of teaching, is effectually guarded against.

† For many of the facts here presented, as well as for others relating to the subject under consideration, acknowledgment is due to the conductors of that useful annual, the American Almanac, commenced at Boston in 1830.

TABLE LI. continued.

Denominations.	Name.	Place.	Date.	No. educated.	Students, 1831.	Vols. in Libra.	No. of Prof.
aptist.	Theological Institution.	Newton, Mass.	1825	25	22	1,020	2
	Hamilton Lit. and Theo. Inst.	Hamilton, N. Y.	1820	100	80	1,600	4
	Rock Spring Seminary.	Rock Spring, Il.	1827		5	1,200	1
utheran.	Hartwick Seminary.	Hartwick, N. Y.	1816				
	Sem. Luth. Church Un. Sta.	Gettysburg, Penn.	1826		43	6,200	2
nita. Congregationalist.	Theological School.	Cambridge, Mass.	1824	87	33		4
utch Reformed.	Theo. Sem. Dutch Ref. Ch.	New Brunswick, N. J.			24		
erman Reformed.	Theo. Sem. Ger. Ref. Ch.	York, Penn.	1825	11	14		2

Besides the foregoing establishments there are scattered throughout the country several schools ostensibly devoted to general education, and manual labour combined, but in fact the pupils are generally considered to be in the incipient stages of preparation for theological pursuits. Of these, there are several in the state of New York, one or more in Maine, and one, at least, in Pennsylvania, which is believed to have recently attached itself to a hitherto vacant college charter, at Easton.

TABLE LII.

List of Medical Schools or Medical Departments of Colleges and Universities in the United States, with their situations, number of Professors and Students.

Names.	Place.	No. of Prof.	No. of Stud.
Maine Medical School.	Brunswick, Me.	4	99
Waterville Med. Sch.	Waterville,	4	28
N. Hamp. Med. Sch.	Hanover,	3	98
Vermont Med. School, Univ. of Vermont,	Burlington,	3	40
Vermont Acad. of Med. Midwifery College,	Castleton,		
Mass. Med. Sch. Harv. Univ.	Boston,	5	95
Berkshire Med. Inst. Wm. College,	Pittsfield,	6	85
Med. Sch. Yale Col.	New Haven,	5	69
Col. Phys. and Surg. N. York,	New York,	7	180
Col. Phys. and Surg. West. Dist.	Fairfield,	5	170
Med. Dep. Univ. Penn.	Philadelphia,	9	350
Med. Dep. of Jeff. Col. Canonsburg,	Philadelphia,	5	100
Med. Dep. Univ. of Md.	Baltimore,	7	
Med. Dep. Univ. of Va.	Charlottesville,	3	
Med. Col. Charleston,	Charleston, S. C.	7	150
Med. Col. Transylvania Univ.	Lexington, Ky.	6	200
Med. Col. of Ohio,	Cincinnati,	8	113

Besides the above enumerated schools of medicine, there are several private establishments organized with a view to render the general studies of the medical student during the intermission of regular courses, more profitable than they could be when confined to the solitary closet. Of these no less than three are known to exist in Philadelphia besides the College of Pharmacy, which is itself intimately connected with medical education and practice. The instructions in the private establishments just referred to, consist of lectures and examinations duly intermixed, and both these have reference to the public lectures and final examinations of the medical colleges to which they may be regarded as subsidiary.

The condition of American law schools can hardly be gathered with sufficient accuracy to enable us to present a regular statement concerning them. They are all of recent origin, and are here presented rather to give a ground to conjecture what will in future be the method of conducting legal studies than to show what is the course now pursued. It is probable that in a very great proportion of cases the old method of gleaning up scraps and fragments of knowledge from the details of business and from irregular application amidst the confusion of the lawyer's office is still pursued. In some instances the law academies enumerated in the following list are merely associations of members of the bar and students, for mutual improvement in their studies by discussions and *moot courts.*

TABLE LIII.

List of Law Schools in the United States.

Name.	Place.	No. of Prof.	No. of Studs.
Cambridge Law Sch. a department of Harv. College,	Cambridge, Mass.	2	41
Law Dep. Yale College,	New Haven,	2	33
Litchfield Law School,	Litchfield,		
Law Acad. of Philad.	Philadelphia,		
Maryland Law School,	Baltimore,	2	22
Williamsburg,	Williamsburg, Va.		9
	Staunton, Va.		
Charleston,	Charleston, S. C.		
	Lexington, Ky.		20

Under the head of professional schools we ought perhaps to class the military and naval school establishments of the country. Of the latter, indeed, we should have little to say, as they have not yet come into being, except in the form of casual arrangements for teaching on board the national vessels and at some of the naval stations.

The military academy at West Point is the only establishment of that description for the service of the army. Its usefulness and eminence are justly deemed the pride of the nation. It sends forth annually about 30 or 40 graduates, and the whole number of cadets in 1831 was two hundred and twenty-two.

6. *Societies for the improvement of education.*—The thoughts and reflections of American citizens have for the last twenty years been frequently called to every branch of the subject both of *education* and *instruction.* The claims of education, moral, intellectual, and physical, have been urged with a zeal worthy of the cause, and with a devotedness which makes ultimate success the certain reward of all human effort. The divisions and subdivisions of the subject have claimed each the labours of many vigorous minds, and though much, very much, yet remains to be done in order to realize the wishes of the wise and good in this particular, the cause is unquestionably making advancement at a speed far more encouraging than at any former period. It may be mentioned as a curious coincidence, illustrative of the rising interest of the subject, that in the year 1825, on one topic in education, the formation of schools for teachers, which had previously been hardly mentioned in public, no less than four distinct publications appeared simultaneously in as many different and distant states, without concert or co-operation on the part of their authors.

These pamphlets were read with attention, became the subjects of frequent comment, and the matters of which they treated have already (1832) been presented in the messages of several governors of states, and acted on by colleges, academies, and private institutions. The fact just stated proves, that reflecting men perceive a capital defect in the system heretofore pursued, to have been the want of a distinct recognition of the business of education as a permanent and honourable pursuit, and the absence of all regular preparation for the duties of instruction. This evil has not been confined to any one class of institutions, but has proved as detrimental to the true interests of the colleges as of the common schools. In the former it has frequently happened that a man of some other profession has been taken from the *ranks* of his own calling and set up at once with the title, dignity, and emoluments of a *commander in chief* in a totally different service; where of course he had every thing to learn, and where his previous habits had done any thing but qualify him for the arduous duties of instruction. The folly of those who select is only equalled, in such cases, by the "modest assurance" of those who accept their appointment.

As a means of advancing the interests of general education, recourse has been had to conventions and associations among the teachers and other friends of the cause, who, by deliberation and the free interchange of opinions, have done much to rouse attention to the various topics connected with the subject, have diffused much useful light and information, and created a more liberal and worthy spirit in regard to the public provisions for education. To the city of Boston is due the credit of having called the first literary convention for the promotion of this honourable cause. This step was to have been expected from a city which may be styled not more emphatically the cradle of *liberty* than that of universal education.

Other convocations for similar purposes have since been held, and have doubtless conferred much benefit on the parties concerned, as well as on those over whom they exercise a control. If they have done no more in some instances, than prove how discordant were the previous opinions of their members and how far the systems and methods pursued in many seminaries are removed from the perfection of which they are susceptible, they will have overcome at least one of the pre-existing obstacles to improvement. The convention at Boston resulted in the establishment of a society termed the "American Institute of Instruction," the members of which, "pledging their zealous efforts to promote the cause of popular education," proceeded to adopt a constitution liberal in its nature and admirably calculated to insure the harmony and co-operation of all ingenuous minds.

While similar associations shall continue to be actuated by equally enlarged and patriotic views, and shall keep clear of all questions and discussions on which, from their very nature, no satisfactory decision can be had, they will doubtless contribute in the most effectual manner to the success of a cause which cannot but be regarded as of the highest individual and national importance.—W. R. JOHNSON.

COMMERCE AND NAVIGATION.

The first settlers of Virginia encountered many difficulties: but such were their industry and perseverance, that by the year 1619, only twelve years after the commencement of the building of Jamestown, they not only stocked the English market with their staple, tobacco, but opened a trade for it with Holland, and established warehouses in Middleburgh and Flushing. As there was a duty of five per cent payable on this article when imported into England, king James did not see with indifference the diversion of a part of his revenue to foreign states: and though the colonists remonstrated against the injustice of the proceeding, they were ordered to bring all their tobacco to England, in despite of their privileges as Englishmen, and of the plain letter of their charter. The injustice did not end here: for tobacco was made a royal monopoly; and the king, "out of pity to the country" as he declared, "commanded that the planters should not make more than one hundred weight of tobacco per man; for the market was so low that he could not afford to give them more than three shillings a pound for it." He, however, sold it out at much higher prices.

The order to bring all their tobacco to England the Virginians evaded; and to their trade with Europe, they added a profitable trade with the Indians for peltry. To these branches of trade was added, in 1620, a trade in slaves, in which year a Dutch ship bound homeward from the coast of Guinea, sold twenty of this wretched race to the colonists.

The order to bring all tobacco to England, appears to have been the only commercial restriction the mother country imposed on the colonies, till the year 1646: for the proclamation issued by king Charles in 1638, prohibiting the sailing of ships with passengers or provisions to New England, without special license, was strictly of a political nature. No duty was charged on goods exported from England to the colonies, and the produce of the colonies when imported into England paid a duty of only five per cent. Foreign vessels were permitted to trade to the colonies, and foreign merchants to settle in them as agents and factors.

Under this system, notwithstanding their frequent wars with the Indians, and many faults in their internal policy, the progress of the colonists in wealth was not inconsiderable. To agriculture and to a trade with the Indians for peltries, the New Englandmen soon added fisheries: and a trade with the West Indies. The introduction of the culture of sugar into Barbadoes, which took place about the year 1641, rendered the last mentioned trade very profitable.

In the year 1646, an ordinance was passed declaring that "whereas the several plantations of Virginia, Bermuda, Barbadoes, and other places, have been much beneficial to this kingdom by the increase of navigation and of the customs arising from the commodities of the growth of these plantations imported into this kingdom. And as goods and necessaries carried thither from hence have not hitherto paid any custom: for the better carrying on of said plantations, it is now ordered by the lords and commons in parliament, that all merchandise, goods, and necessaries for the supportation, use, and expense of said plantations, shall pay no custom nor duty for the same, the duty of excise only excepted, for three years to come, except to the plantations in Newfoundland; security being given here, and certificate from thence, that the said goods be really exported thither, and for the only use of the said plantations.—Provided always, that none in any of the said plantations do suffer any ship or vessel to lade any goods of the growth of the plantations, and carry them to foreign parts, except in English bottoms: under forfeiture of the before named exemption from custom."

A jealousy of the Dutch, partly political and partly commercial, led to the enaction of this, the first of the British navigation acts, touching the colonies. It left the colonists at liberty to export their produce whither they chose, provided it was exported in English bottoms: and it did not prevent foreign ships from making sales of cargoes in the colonies, but only from taking in lading there. Such was the letter of the law. The penalty imposed for a breach of it, or rather the favour offered for the observance of it, a continuance for three years only of an exemption from customs on goods exported from England to the colonies, was so inconsiderable, that it was probably little regarded. Without understanding the philosophy of free trade, the colonists had practical experience of its benefits: and the Virginians were little disposed to obey the ordinances of a parliament which had set the royal power at defiance.

Against this parliament, indeed, the Virginians openly raised the standard of opposition, whereupon an ordinance was issued in 1650 prohibiting all correspondence with them except by leave of the council of state, authorising the capture of their ships and merchandise, and prohibiting, under forfeiture of ships and goods, any foreigner from resorting to Virginia, or trading thither, without a license, on any pretext whatever.

This ordinance did not affect the New England provinces or Maryland, but in the following year it was enacted that no "merchandise either of Africa, Asia, or America, including our plantations there, should be imported into England, in any but English built ships, and belonging either to English or English plantation subjects."

This ordinance of the rump parliament was the basis of the celebrated British *navigation act*, passed in 1660, after the restoration of Charles the second. The latter act made it illegal to trade with the colonies except in British and British plantation ships, and forbid foreign merchants to settle there. It prohibited the Americans from carrying tobacco, sugar, cotton, wool, indigo, ginger, fustic, and other dying woods, to any places but England, Ireland, and his majesty's plantations: but left them at liberty to carry other articles of their produce to foreign countries, and there to purchase such merchandise as they might want. But this last mentioned privilege was confined within very narrow limits by another act, passed in 1663, by which it was declared that no merchandise of European growth, production, or manufacture, should be imported into the colonies, except it were laden or shipped in England, with the exception of "salt for the fisheries, wines from Madeira and the Azores, and *servants*, victuals, and horses from Scotland or Ireland."

The restrictions the British government imposed on its plantations, were similar to those adopted by other European powers. The design of each was to monopolise the trade of its own colonies, and in their acts of pacification in regard to America, it was usual to insert an article binding the subjects of each contracting power, mutually to abstain from sailing to or trading in any of the harbours, or places, possessed by the other party in the western hemisphere. While the laws of England, therefore, restricted the North Americans to purchasing European commodities in the markets of England, a few articles only excepted, the laws of France and Spain restricted their commerce in America to the British colonies. But the North Americans were not very strict in their observance of any of these regulations. In defiance of the Spanish monarch, they appear to have entered into a contraband trade with the Spanish colonies before the year 1660. They began to cut logwood in the bay of Campeachy in 1662, and in 1669 they carried considerable quantities of that article to Jamaica and to New England. They also entered into a trade with the French colonists. Of their not paying strict regard to the British navigation laws, we have evidence in a proclamation issued by king Charles, in 1675, "for prohibiting the importation into his American plantations of any European merchandise but what should be laden in England: and for putting other branches of those acts into strict execution relating to America." Sir Josiah Child, in his discourse on trade, published about the year 1670, among other charges against the New Englandmen, asserts that "they do sometimes assume the liberty of trading contrary to the act of navigation, by reason of which many American commodities, especially tobacco and sugar, are transported in New England shipping, directly into Spain and other foreign countries, without being landed in England, or paying any duty to his Majesty."

As a settlement was not effected in Carolina till 1663, as the British did not get possession of New York and New Jersey till 1664, and as Pennsylvania was not settled till 1682, the British colonial policy was matured in all its essential principles, when the only colonies of any importance on the continent were those of Virginia, Maryland, and New England. At this early period do we find their commerce of importance enough to excite the monopolizing spirit of the mother country, and the people bold enough to break through the restraints imposed on them by transatlantic policy.

They prosecuted their various branches of business with great vigour. Tobacco was the great staple of the people of Maryland and Virginia. The New Englandmen had various articles of export. To the West Indies they sent dry codfish, salt mackerel, beef, pork, bread, beans, flour, peas, and other provisions, "to the diminution," says Sir Josiah Child, "of the vent of these commodities from this kingdom: the great experience of which, in our West India plantations, would soon be found in the advantage of the value of our lands in England, were it not for the vast and almost incredible supply these colonies have from New England." To England they sent great masts, furs, and train oil: but the greater part of their payments for English manufactures were made in sugar, cotton, wool, tobacco, and the other productions of Virginia and the West Indies.

In 1690, to the cod and mackerel fisheries which had been prosecuted from an early period, the Americans added the whale fishery. It originated at the island of Nantucket in boats from the shore. In 1715, six sloops of thirty-eight tons each, were employed in this fishery from that island. For many years their adventures were confined to the American coast, but as whales grew scarce here, they were extended to the Western Islands, and to the Brazils, and at length to the North and South Seas.

About the year 1694, the cultivation of rice was introduced into South Carolina. It soon became the staple of that country; and in 1706, was, by an act of parliament, placed among the enumerated commodities, and could only be shipped directly to Great Britain: but, afterwards, in the year 1730, it was permitted, under certain limitations and restrictions, to be shipped directly from Carolina to any part of Europe south of Cape Finisterre.

In 1703, the Swedes absolutely refused to let the English have any pitch or tar, although ready money was always paid for it, unless England would permit it all to be brought in Swedish shipping, and at their own price. This induced the British government to offer a bounty of four pounds per ton for pitch and tar, three pounds for rosin or turpentine, six pounds for hemp, per ton, and one pound per ton for all masts, yards, and bowsprits, imported from the English plantations in America. The materials for the production of pitch, tar, and turpentine, being abundant in America, 6000 barrels of these articles were sent from New England in one fleet, and great quantities from the southern colonies. In 1729, new and more moderate premiums were granted on these articles.

The repeated, perhaps we ought to say habitual violations by the Americans of the Navigation Law of 1660, induced the British parliament to attempt to strengthen that law by another act in 1696, by another in 1707, and by a third in 1742.

About the year 1715, the British colonists in the West Indies, began to complain of the North Americans supplying the Dutch colony of Surinam "with vast numbers of small horses, and with provisions, fish, &c. In return for which they took molasses, which they made into rum." This trade was not contrary to the spirit of the British trade acts, for that government had no objection to its subjects breaking in upon the colonial monopolies of the other European powers; but the British West India planters continuing their complaints of the trade with the Dutch, and adding thereto complaints of a similar trade carried on with the French and Danish colonists, a bill was passed by the House of Commons in 1731, to prohibit, under the penalty of a forfeiture of ship and cargo, the importation of sugar, rum, and molasses, from the plantations of foreign powers, and to require bonds from the exporters of horses and lumber, that they should not carry them to any foreign country. The British West Indians asserted that the North Americans were enabling the colonists of other European powers to undersell them in the sugar market. The North Americans, on their part, contended that if they were deprived of this commerce, they could not obtain rum and molasses enough for the Indian trade and the fisheries, nor specie to pay for British manufactures. Their representations were so cogent that the bill was dropped in the House of Lords; but the West India planters continuing their complaints, to pacify them a bill was passed by parliament in 1733, imposing a duty of ninepence sterling on every gallon of rum imported from foreign colonies into the British plantations in America, sixpence on every gallon of molasses, and four shillings on every hundred weight of sugar and paneles—to be paid down in ready money by the importers before the landing of the same.

This duty on rum was afterwards reduced to sixpence, and that on molasses to three-pence a gallon. It was always very odious to the northern colonists; being justly considered by them as sacrificing their interests to those of the sugar planter. And it is well known, says Mr Pitkin, that although this duty was attempted to be collected in the colonies, by officers appointed by the crown, and by severe legal penalties, yet by smuggling, or some other way, the payment of it was generally evaded.

Under regulations of this kind, modified from time to time in the details, and observed by the Americans with no great strictness, when regarded by them as injurious, the trade of the colonists continued till the year 1763; grain, salted provisions, and other of their most valuable products, being among the non-enumerated articles, they could carry to any part of Europe. In 1705, molasses was added to the list of articles which could be legally exported only to England or British possessions. In 1722, beaver, and peltry, and copper ore, were included in the list, which was further extended in 1729, by the addition of tar, turpentine, masts, yards and bowsprits, and in other years, by the addition of pig and bar iron, pot and pearl ashes, whale fins, hides, and some other commodities.

In 1730, among the new articles of import from the colonies into England, were fifty hundred weight of hemp, raised in New England and Carolina, and forty tons of iron, thirty hundred weight of copper ore, one hundred and fifty-six quintals of beeswax, three hundred weight of hemp, and three hundred weight of raw silk, produced in Virginia.

About the year 1741, the Carolinians being deprived of a market for their rice by the wars in Europe, began to cultivate indigo.

In 1749, the bounty granted to British whaling ships was extended to American whaling ships under certain limitations. In the same year permission was given to import American raw silk into England, free of duty: and in the following year the privilege was extended to pig and bar iron.

In 1764, acts were passed to prohibit the importation of sugar and rum from the foreign colonies into the American colonies, to lay a duty of one pound two shillings per cent on all foreign clayed sugars imported into the colonies, instead of the old duty of five shillings and six-pence, to lay a duty of six-pence a pound on foreign indigo, instead of the old duty of two-pence, on foreign coffee a duty of two pounds nineteen shillings and nine-pence, on Madeira wine a duty of seven pounds per ton, on Port and Spanish wines imported into the colonies from Great Britain ten shillings per ton, on Asiatic silks and silk stuffs two shillings sterling a pound, on Asiatic calicoes two shillings six-pence a piece, on foreign cambrics and French lawns three shillings sterling a piece, on coffee exported from the British West Indies to any place but Great Britain seven shillings sterling per hundred weight, on pimento one half-penny sterling per pound. These provisions for imposing duties on various articles when imported into America, were accompanied with others for withdrawing the drawback which had usually been allowed on the exportation from England to the colonies, of different articles of European growth and manufacture. It was enacted "that there be not any drawback allowed of any part of the rate or duty of the old subsidy on any foreign goods, (except wines), of the growth, product, or manufacture of Europe, or the East Indies, exported from this kingdom to the British colonies in America. That no drawback be allowed of any part of any rate or duty upon white calicoes or foreign linens."

As the duties imposed by the act of 1733 were seldom paid, it was resolved to support the new commercial regulations by a naval force on the coast. The consequences of these measures were so important, that we feel we cannot render a more acceptable service to our readers, than by transcribing the statement of Mr Coombe, the continuer of Anderson's History of Commerce, a work which has not been republished in the United States.

After mentioning the necessity the British minister, Mr Granville, found himself under of increasing the public revenue, on account of the increase of the public debt, he says, "The methods which were now adopted to prevent smuggling, might not have been attended with any unpleasant consequences, if they had been confined to the coasts of Great Britain and Ireland; but by extending them to the shores of America, they interrupted a commerce, which, though not strictly legal, was extremely advantageous to the colonies. They were, therefore, in a state of no common discontent on account of the acts of the British parliament, which added to their restraints, when the stamp act appeared to heighten their resentment, and raise a kind of private displeasure into public remonstrance and general opposition.

"A number of armed cutters were stationed around the coasts of Great Britain, and the most rigid orders were issued to the commanders of them to act in the capacity of revenue officers. They were enjoined to take the usual customhouse oaths, and to observe the regulations prescribed by them. Thus was the distinguished character of a British naval officer degraded by the employment of a tide waiter, and that active, zealous courage which had been accustomed to the conquests of an enemy, was now to be exerted in opposing a contraband trade, and to find a reward in the seizure of prohibited commodities.

"The clamour against these measures was loud in England: but in America the discontent on the occasion was little short of outrage. As naval gentlemen, the commanders of these vessels were not conversant in the duties of revenue collection; they were, therefore, oftentimes guilty of oppression: remedies were indeed at hand in England; but as the lords of the admiralty or the treasury could alone rectify any errors, check any violence, punish any injustice, or restore any violated property, it was always extremely difficult, and in many cases almost impracticable, for the Americans to obtain redress.

"But bad as this evil was, there arose one from the same source which was still worse. A trade had been carried on for more than a century between the British and Spanish colonies in the new world, to the great advantage of both, but especially the former, as well as of the mother country: the chief materials of it being on the side of the British colonies, British manufactures, or such of their own produce as enabled them to purchase British manufactures for their own consumption; and on the part of the Spaniards, gold and silver in bullion and coin, cochineal, and medicinal drugs, besides live stock and mules; which, in the West India plantations, to which places alone these articles were carried, from their great utility justly deserved to be considered of equal importance with the most precious metals.

"This trade did not clash with the spirit of any act of parliament made for the regulation of the British plantation trade; or, at least with that spirit of trade which universally prevails in our commercial acts: but it was found to vary sufficiently from the letter of the former, to give the new revenue officers a plea for doing that from principles of duty, which there were no small temptations to do from the more powerful motives of interest. Accordingly, they seized, indiscriminately, all the ships upon that trade, both of subjects and foreigners, which the customhouse officers stationed on shore, either through fear of the inhabitants, a more just way of thinking, or a happy ignorance, had always permitted to pass unnoticed.

"As the advantage of this commerce was very much in favour of Great Britain, the Spanish monarchy had always opposed it: guarda costas were commissioned to scour the coasts of her American dominions, and to seize every vessel that approached too near them; a duty which they had exercised with such general license, as to provoke the war which broke out in 1739. The British cruizers seemed to act at this time with the same spirit in destroying this commerce, so that in a short space of time it was almost wholly annihilated.

"This circumstance was to the northern colonies a deprivation of the most serious nature. This traffic had long proved the mine from whence they drew those supplies of gold and silver that enabled them to make copious remittances to England, and to provide a sufficiency of current specie at home. A sudden stop being thus put to such a source of advantage, the Americans expressed the injury they sustained in the harshest terms that a sense of injury could inspire. But in spite of all complaints, the ministry continued to proceed in their unfortunate career, and measures equally offensive to the inhabitants of the North American colonies continued to be successively adopted.

"Besides this trade, carried on between the British colonies in general, especially those in the West Indies, and the Spanish, there had for a long time subsisted one equally extensive between the British North American colonies in particular, and those of the French West Indies, to the great advantage of both, as it consisted chiefly in such goods as must otherwise have remained upon the hands of the possessors; so that it united, in the strictest sense, all those benefits which liberal minds included in the idea of a well regulated commerce, as tending, in the highest degree to the welfare of those concerned in it.

"In these benefits the respective mother countries had, without doubt, a very large share, though it may be impossible to determine which, on the whole, had the most. We had enough to engage those in power to think it worth connivance, for it certainly was not strictly according to law, in consideration of the vast quantity of manufactures it enabled our American colonies to take from us; and this also, in spite of all the clamours which those concerned in our West India trade and possessions could raise against it, as enabling the French to undersell them in West India produce at the foreign markets. This outcry might, indeed, be found to arise, in a great measure, from another consideration, which it was not proper for these gentlemen to avow, that of their not getting so good a price as otherwise they might expect, for such part of their produce as they sold in the markets of their mother country: and which, considering the vast demand for it, even to the poor, to whom, from long habit, it has become one of the chief necessaries of life, it would have savoured of oppression if it had been permitted to advance in price. But, be that as it may, this trade was suffered to be carried on in the late war between Great Britain and France; directly by means of flags of truce, and indirectly through the Dutch and Danish islands; and afterwards through the Spanish port of Monte Christe, in the island of Hispaniola; till, at last, the vast advantages the French received from it above what the English could expect, in consequence of our having, in a manner, laid siege to their West India islands, determined government to put a stop to it.

"In doing this, however, they did not think proper to consider it so much in the light of a contraband trade, as in that of a treasonable practice, by supplying the enemy with necessaries, without which it would have been impossible for these valuable islands to hold out so long against our attempt to reduce them. Accordingly, as soon as the conclusion of the war had taken the appellation of treason from this trade, it returned again to its pristine flourishing condition; and thus it remained, till it sunk beneath the same blow with the trade between us and the Spaniards, whose history we have already related.

"This trade not only prevented our North American colonies from being drained of their current cash, by calls of the mother country, but added greatly to it, so as to make it in some measure keep pace with their domestic trade, which could not but greatly increase in proportion to the remarkable increase of mankind in that part of the world, where the cheapness of the lands determines so great a part of the inhabitants to the exercise of the rural arts, which are known to be favourable to population.

"Though the suppression of that trade which we have just been relating, instead of barely interrupting these supplies of the necessaries and conveniences of life, which the North American colonies were before accustomed to receive in return for their superfluities and incumbrances, tended visibly, by obstructing their internal commerce, to deprive them, in a great degree, even of these blessings, the sources of which lay within themselves; yet a law was made in the beginning of the last year (1764), which, whilst it rendered legal, in some respects, their intercourse with the other European colonies in the new world, loaded the best part of it with duties so far above its strength to bear, as to render it contraband to all intents and purposes.

"Warm and spirited remonstrances were sent to England on the occasion, by the people of North America. Among other arguments, they alleged that such restraints upon their trade were absolutely ruinous, as they tended to put an end to the clearing of their lands, and damped the prosecution of their fisheries. They also asserted, that unless those foreign ports where they deposited the surplus of their corn, and of the provisions of all kinds with which their country abounded, were freely opened to them, they knew not whither to carry them. The British islands in the West Indies were not equal to their consumption, and Great Britain did not want them: it was absolutely necessary, therefore, that some places for the disposal of them should be permitted, where they might fetch a reasonable price."

While the people were in the state of mind produced by the restrictions imposed on their trade by the acts of 1764, the stamp act was passed, and the first of November 1765 fixed on as the day in which it should go into operation. The measures which were thereupon taken by the inhabitants and the governments of the different colonies belong to the political history of the country.

In the following year the stamp act was repealed: but the British parliament did not relinquish its pretensions to a right to tax the colonies, and passed an act "to amend an act for regulating certain duties in the British colonies and plantations, and also duties upon East India goods exported from Great Britain, and for granting other duties instead thereof, and for further encouraging, regulating, and securing several branches of the trade of this kingdom and the British dominions in America, as relates to the exportation of non-enumerated goods from the British colonies in America."

This act was not of a character to allay the irritation of the Americans, as it prevented them from exporting to any of the countries of Europe north of Cape Finisterre, except England, any of the articles before known as non-enumerated commodities.

In 1767, an act was passed which imposed duties on teas, paper, painters' colours, and glass imported into the British plantations in America.

In 1770, the duties on paper, painters' colours and glass were repealed: "but in order to preserve the dignity of the legislature, and merely to save the national honour, the duty on tea was continued."

In 1775, a bill was passed to prohibit all trade and intercourse with the colonies in actual rebellion: and in the same year a resolution was passed by Congress shutting every port in the country against British ships.

We have thus brought up our commercial history to the commencement of the revolutionary war. Many of the incidents which followed the passage of the acts of 1764, we have thought it unnecessary to introduce, as they are related in the popular histories of that period. The facts we have stated are sufficient to show that it was interference with their trade that roused the Americans to assert the principle, that no body of men had a right to tax them without their own consent. This ground once taken by them, the evil or the good that the commercial regulations of the mother country might do them, was lost sight of in attention to the principle. Various attempts were made by the British parliament to conciliate them by granting bounties on raw silk, on oak staves, and on building timber, by taking off some of the restrictions on the exportation of rice, and by reducing the duties on many imported articles to a nominal amount: but the Americans having once asserted the principle, that the British parliament had no right to impose any tax or duty upon them, maintained their cause with a spirit which deserved and which obtained success.

According to the statement of Lord Sheffield, the customs from the 5th of January 1768, when the board was established, to 1775, when the war began, amounted to about 290,000*l.* or about one million three hundred thousand dollars, in a little more than seven years, out of which the expense of collection was to be deducted.

It is difficult, as Mr. Pitkin justly observes, to ascertain the value of the trade of the colonies previous to the year 1776. As a very extensive commerce was carried on without regard to British regulations, the custom house books do not furnish a full account. They must, however, be referred to, as the best source of information. Table No. 54 gives the official value in sterling money of the exports and imports from each of the colonies, now states, for the year 1769. From this it appears that the exports amounted to £2,852,441, or about thirteen millions of dollars, and the imports to £2,623,412, or about twelve millions of dollars. Of the exports, more than one half were to Great Britain, a little less than one fifth to the south of Europe, something more than a fourth to the West Indies, and a small amount to Africa. Of the imports, nearly two thirds were from Great Britain, and more than one fourth from the West Indies. The imports from Africa amounted to upwards of $670,000. Those from the north of Europe to little more than $340,000. This was after the restrictive acts were passed by the British parliament. In previous years, the proportion of trade with different countries must have been different.

The tables of Lord Sheffield, in his "Observations on American Commerce," taken undoubtedly from the custom-house books, show the value of the trade between Great Britain and that part of America now the United States, from 1700 to 1780, to have been as follows:

Average	Imports from. £.	s.	d.	Exports to £.	s.	d.
From 1700 to 1710,	265,783	0	10	267,205	3	4
" 1710 to 1720,	392,653	17	1½	365,645	6	11¼
" 1720 to 1730,	578,830	16	4	471,342	12	10½
" 1730 to 1740,	670,128	16	0½	660,136	11	1¼
" 1740 to 1750,	708,943	9	6¼	812,647	13	0¼
1750 to 1760,	802,691	6	10	1,577,419	14	2½
1760 to 1770,	1,044,591	17	0	1,763,409	10	3
" 1770 to 1780,	743,560	10	10	1,331,206	1	5

This is the British official valuation, which, for most articles, is much below the market valuation.

Table No. 55 contains an account of the principal articles exported from the North American colonies, including the islands of Newfoundland, Bahama, and Bermuda, with their official value and places of destination for the year 1770. "As little," says Mr. Pitkin, "was exported from the other provinces and the islands, except fish from Newfoundland, the value of the exports from the colonies, now the United States, in that year, must have been at least three millions sterling, or about thirteen and a half millions of dollars."

It is not easy to ascertain the amount of tonnage employed in the trade of the colonies, and particularly the amount owned by the colonists themselves.

The author of a work published in London, in 1731, entitled "The Importance of the British Plantations in America," estimates the amount of tonnage employed in bringing tobacco from Virginia and Maryland to England at 24,000 tons. "The trade of these two provinces to all other parts than Great Britain is," he adds, "inconsiderable, not employing above one thousand tons of shipping to the sugar islands and in all other trades, on their own proper account. Yet there is a great number of vessels that trade to both provinces, of and from our other continental colonies."

"The Pennsylvanians build about two thousand tons of shipping yearly for sale, over and above what they employ in their own trade, which may be about six thousand tons more."

"New England employs about 40,000 tons of shipping in its foreign and coasting trade, and above six hundred sail of ships, sloops, &c., about one half of which shipping trades to Europe. Their fisheries have been reckoned annually to produce 230,000 quintals of dried fish. By this fishery, and their other commerce, they are said to employ at least six thousand seamen. There is, moreover, their whale fishery, employing about one thousand three hundred tons of shipping."

This account is very imperfect. When the author speaks of New England, he has special reference to Massachusetts; and we have no account of the shipping employed in the trades of New York, New Jersey, and the Carolinas.

The amount of tonnage entered from January 5, 1770, to January 5, 1771, was 331,644, and the amount cleared 351,686 tons. This includes the entry of the same vessel two or three times, or as often as the voyages were repeated in the course of the year. "Although," says Mr. Pitkin, "the tonnage, as registered, is generally less than the real amount, yet the tonnage, as entered and cleared, is probably much above its real amount."

In 1769, the vessels built in the colonies, which afterwards formed the United States, amounted to 20,000 tons; in 1770, to 20,610 tons; and in 1771, to 24,068 tons. In 1772, the number of vessels built was 182, the aggregate tonnage of which amounted to 26,544 tons.

During the war of the revolution, the foreign commerce of the United States was very limited in amount, and conducted at great risk. In 1779, the insurance on specie imported from Europe was more than 50 per cent. In 1782, the rate of insurance, at London, on ships to New York, with convoy, was 15 guineas per cent. With so much vigour was the war on the ocean prosecuted, that a statement was made to parliament, in the year 1778, that 733 British ships had been taken by the American cruisers, and that though 47 of them had been released, and 127 retaken, the loss of the remaining 559 vessels, which were carried into port, appeared, from the best mercantile information, to amount to at least £2,600,000 sterling. The number of American ships captured at that time was said to be 904, which, at the moderate valuation of £2000 for each ship and cargo, would amount to £1,808,000.

The American fisheries were completely destroyed. A clandestine commerce was, from the commencement of the war, carried on with Holland, and, toward the end of it, a lucrative trade with the Havana: but so much of the labour and the capital of the people were diverted from their old channels, that there was little surplus produce for foreign markets. What the husbandmen did not consume themselves, was insufficient to supply the wants of the contending armies. The prosecution of many arts and trades was suspended, from the impossibility of obtaining raw materials; and much meat was spoiled, owing to the want of salt to preserve it. The last mentioned article was, at times, as high as eight dollars a bushel, and was, on an average, perhaps, as high as three or four dollars.

The return of peace found the Americans without shipping, and with a reduced commercial capital. Many of the labouring people had been cut off by the events of the war, and others had, while in the army, acquired habits which unfitted them for the pursuits of peace. In many parts of the country, the improvements on the farms had been destroyed. Through the operation of the continental money, and other causes, a new distribution of wealth had taken place; a distribution alike unfavourable to private happiness and public prosperity. Unprincipled speculators revelled in luxury; while the honest and the noble minded, who were the principal victims of the financial systems of the different governments, found it difficult to obtain the bare means of subsistence. Land speculations and speculations in the soldiers' certificates engaged the attention of many who had money. Time was required by those of the industrious classes who had not been entirely stripped of their property, to bring their farms into the condition in which they were before the war, or to re-establish themselves in their old avocations. Tender-laws and other measures, the plea for which was state necessity, had destroyed the confidence of men in one another. The effects of the war continued to be felt for many years after the return of peace.

It was impossible that the country could, under such circumstances, furnish a great amount of commodities for exportation: but a brisk trade of import from England immediately commenced. We find Lord Sheffield, who wrote in an early part of 1783, before the articles of peace were signed, stating that the American market was absolutely glutted with European products: and Mr. Pitkin estimates the value of the goods imported into the United States from England, at eighteen millions in 1784, and at twelve millions in 1785.

The following is an account of the imports into England from the United States, and exports to the United States from that country, in sterling money, from 1784 to 1790, taken from the English custom-house books, viz.

Years.	Imports.	Exports.
1784,	£749,345	£3,679,467
1785,	893,594	2,308,023
1786,	843,119	1,603,465
1787,	893,637	2,009,111
1788,	1,023,789	1,886,142
1789,	1,050,198	2,525,298
1790,	1,191,171	3,431,778

The British official value, it must be kept in mind, is, for most articles, much below the market value.

These importations were paid for, in part, out of a fund of gold and silver, which the expenditures of the British and French armies in the country had enabled certain individuals to accumulate during the war.

Of the extent of our commerce with other countries, in the period that elapsed between the close of the war and the adoption of the federal constitution, it is difficult to form an estimate. It must have been small, as we had little to sell, and the other European merchants were not willing to give as long credits as the British.

During this period, our foreign commerce was subject to various and uncertain regulations. The privileges of a trade to their West India colonies, which France and Spain had conceded during the war, were, soon after the return of peace, diminished, and, after that, in a manner abolished. The policy of Great Britain, though founded on equally selfish principles, was more enlightened. She admitted "any unmanufactured goods and merchandise, the importation of which was not prohibited by law (oil excepted), and any pitch, tar, turpentine, indigo, masts, and bowsprits, being the growth or production of the United States, to be imported in British or American ships, upon paying the *same* duties as if imported from the British plantations," and allowed the same drawback on goods exported to the United States as on goods exported to her own colonies. By this act, pot and pearl ashes, bar iron, woods of every kind, and tar and pitch, being the produce of the United States, were more favoured than the same articles of the growth of other foreign countries: but, by the same act, it was provided that the intercourse between the United States and the British West Indies, should be carried on in British ships only, and restricted to an exchange of lumber, naval stores, hemp, and flax, and grain, on the one hand, for rum, sugar, molasses, coffee, cocoa nuts, ginger, and pimento, on the other. This allowed the Americans to purchase from the British West Indies, all the staple products of those islands, but did not allow them to sell to them any salt fish, salt beef, salt pork, and various other articles.

The general restrictions on commerce, by which every maritime power sought to promote its own navigation, and that part of the European system, in particular, by which each aimed at a monopoly of the trade of its colonies, was, says Judge Marshall, felt with peculiar keenness when practised by England. To the British regulations, on this subject, the people of America were, perhaps, the more sensible, because, having composed a part of that empire, they had grown up in the habit of a free admission into all its ports. In 1784, several of the states endeavoured to countervail the British regulations, by imposing duties on British West India products, and on British ships trading there; and in the following year, the legislature of Massachusetts prohibited the exportation of American products in British bottoms, under the penalty of a forfeiture of ship and cargo.

In some of the states, a discriminating duty of one shilling sterling a ton was levied on foreign shipping, in others a duty of three shillings. While Pennsylvania imposed a duty on imported goods, they were admitted free of duty in New Jersey. Congress made several efforts to obtain from the states power to levy a duty of five per cent on foreign commodities, and make it general throughout the country; but from devotion to state rights, jealousy of trade, and a fear that unequal burdens would be imposed on the different members of the confederacy, every proposition of this kind was rejected.

In 1785, an attempt was made to enter into a commercial treaty with Great Britain; but that government declined even to enter into negotiation on the subject, giving as a reason, that congress had not power, under the articles of confederation, to cause such a treaty to be observed. Attempts which were made to negotiate commercial treaties with France, Spain, and Portugal were equally unsuccessful. From the navigation of the lower part of the Mississippi, the Americans were excluded by the Spaniards; and from the Mediterranean, they were shut out by the Barbary powers, whose hostility they had no force to subdue, and whose friendship they had no money to buy. Under these circumstances, to use the language of Dr. Seybert, "it was manifest that general regulations were essential to the safety and welfare of the union: it was absolutely necessary that the power to regulate and control our intercourse with foreign nations, should be confided to congress alone; and it was *that* conviction which principally induced the people of the United States to call the convention to revise the articles of confederation."

Though affairs, both at home and abroad, were very discouraging, the spirit of American enterprise was not damped. Immediately after the peace, a trade was opened with the British East Indies: and on the 22d of February 1784, the first ship sailed from New York for China. In 1789, there were fifteen American vessels at Canton, which was a greater number than any European nation had there, except the English. It was stated in congress, on the 4th of May 1789, that there were forty-seven American vessels on voyages beyond the Cape of Good Hope.

In 1788, the trade to the Northwest Coast of America commenced. The first ship that was employed in it sailed from Boston. This opened a trade for furs with the Indians, on a coast several hundred miles in extent: and afterwards every island in the South Seas, and the whole coast of South America, were explored, in search of seal skins for the Chinese market. These sealing voyages were at first very profitable: but the business was soon overdone, and the seals, in a few years, became so scarce as not to be worth the pursuit.

The old branches of industry revived gradually. The cod fishery was one of the first completely re-established. In 1789, we exported 371,319 quintals of fish, which was more than had been exported yearly, on an average of ten years preceding the revolutionary war. This was, however, overdoing the business, for the British had in the interim greatly extended their fisheries, and our market for fish was limited. The citizens engaged in this business met with heavy losses, which, in 1789, induced the people of Marblehead alone to take thirty-three of their vessels from the fisheries.

The first congress that met under the new constitution passed an act imposing duties of five per cent on most manufactures of wool and flax, seven and a half per cent on manufactures of silk, cotton, and iron, ten per cent on articles composed wholly or chiefly of gold, silver, pearls, and precious stones, and equally moderate duties on most other imported commodities. They also imposed a discriminating duty in favour of American tonnage, and made certain allowances on the exportation of salt fish, as a compensation for the duty paid by the fishermen on foreign salt. This tariff, taking the place of the diversified regulations of the states, imparted uniformity to the commerce of the Union with foreign nations. The principal advantages, however, which trade and industry derived from the adoption of the new constitution, were from those provisions in that instrument which prohibited any state "from emitting bills of credit, making any thing but gold and silver a legal tender in the payment of debts, or passing any law violating the obligations of contracts." These provisions re-established commercial confidence.

By this time, a new class of labourers had risen up: those who were boys at the close of the revolutionary war, had become men. The devastations of the contending armies had been in a degree repaired: and though neither our agricultural nor commercial capital was equal to what it was in 1770, the country afforded a considerable amount of surplus products for exportation, which surplus increased yearly.

The same year in which our new constitution went into operation, the French revolution commenced. The events that grew out of it, while they raised the price of our staples in foreign markets, compelled the different European powers to relax their colonial policy.

The combined effect of these different causes became very apparent by the year 1794, in which and the succeeding year our exports amounted to eighty millions of dollars, being twice as much as we had exported in 1791 and 1792. Part of this increase was owing to a rise in the value of our staples, prices being, according to a statement by Mr. Gallatin, forty per cent beyond their usual rates. Part of it was owing to the re-exportation of foreign commodities, the value of which, in these two years, 1794 and 1795, was, we learn from the same authority, twenty-five millions of dollars.

It was believed by many, that the external causes which had proved so powerful a stimulus to our commerce, would be temporary in their nature: but they continued in operation for more than twenty years; and the causes of internal prosperity becoming at the same time more efficacious, our commerce advanced with a rapidity, of which the history of no nation affords a parallel. Mr. Gallatin, writing in 1796, seemed to suppose that our commerce had, in 1795, nearly reached its maximum; but in 1796 the exports amounted to 67 millions, giving an increase, in a single year, of 43 per cent. In the year 1801, they amounted to 94 millions.

We were the carriers of much of the produce of the East and West Indies. The treasures of South America passed through our country, on their way to Europe. Our merchants carried on a lucrative business in supplying the West Indians and South Americans with European commodities.

Our tonnage increased at a rapid rate. In 1793, the total was 491,780. In 1801, it was 1,033,218. In 1793, it exceeded that of any other nation, except the British. In 1801, it appears to have been nearly equal to that which the Dutch possessed in the period of their greatest commercial prosperity.

The profits on the American tonnage employed in the foreign trade, from 1795 to 1805, if calculated at the rate of $50 a ton, must, according to the estimate of Dr. Seybert, have produced, for the freight alone, $32,459,350 per annum.

Our prosperity was much increased by the addition of a new article to our staples. In 1789, a member of congress, from South Carolina, stated, that the people of the southern states intended to cultivate cotton, and added, "if good seed could be procured, he hoped they might succeed." In 1790, the first parcel of cotton, of American growth, was exported from the United States, and amounted to only 19,200 lbs. Prior to 1802, the cotton wool of foreign and domestic growth was blended in the custom-house returns. On the average of the five years from 1802 to 1806, the cotton of American growth, annually exported, amounted to 42,147,653 lbs. In 1809–10, the export amounted to 93,361,462 lbs.: and 16,000,000 lbs. were consumed in our own manufactories.

After the peace of Amiens, which took place in the fall of 1801, our commerce declined; but that peace continued for only eighteen months, and commerce revived again. Our carrying trade increased, so that in the years 1805, 6 and 7, our exports of foreign produce exceeded those of domestic. The former were annually, on an average of the three years, $57,701,937: the latter $44,863,507.

The prosperity of our trade excited the envy of the different powers of Europe. To reduce its amount, to make it tributary to their own wants, and to promote their belligerent purposes, they issued various orders, edicts, and decrees, the bare enumeration of which would exceed our limits. This system began at an early date, for it was stated, in the British house of peers, that 600 American vessels were seized or detained in British ports, between November 6, 1793 and March 28, 1794. The captures of American vessels, made by the British, from 1803 till November 1807, amounted to 528. Those made by the French, from 1802 till the time of passing the Berlin and Milan decrees, were 206;—during the continuance of said decrees, 307. To these were added seizures by the Neapolitans, the Danes, and the Spaniards.

Many of these violations of neutral rights would, according to the laws of nations, have justified severe retaliatory measures on our part, but the government of the United States, averse to war, resorted to a measure which, perhaps, inflicted more evil on its own citizens than on the offending belligerents. On the 22d of December 1807, an *embargo* was laid on all the vessels in the United States. That act continued in force till the 1st of March, 1809. At the moment when our foreign commerce had arrived at the maximum, it was completely suspended. This transition was the more severe, because of its having been so suddenly adopted.

On the removal of the embargo, the trade in foreign commodities was recommenced; but the amount re-exported in 1809, 10 and 11, was only little more than one-third of what was re-exported in 1805, 6 and 7. The value of the domestic commodities exported in 1810 and 11, was nearly as great as the value of the like commodities exported in the two years previous to the embargo. In 1810 and 11, we found a very profitable market for our flour in Spain and Portugal. The wheat and flour we exported to these countries, in 1811, were valued at not less than eight millions of dollars, at the place of exportation, and at twelve millions, at the places of sale.

The belligerents persisted in their system of spoliation. After the revocation of the Berlin and Milan decrees, the French captured 45 of our vessels. From 1807 till 1812, the British took 389 of our vessels, making a total of 917 captured by them in ten years.

In the opinion of the majority of the nation, war was necessary to redress these wrongs. War was, accordingly, declared against Great Britain, on the 18th of June 1812. One of its necessary effects was to subject our foreign commerce to great risks: yet we exported to Spain and Portugal 938,944 barrels of flour in 1812, and 973,500 barrels in 1813. The value of the wheat and flour exported to those countries, in 1813, was $11,213,447, at the places of exportation. In a foreign market, says Pitkin, their value could not be less than fifteen millions. In 1814, in consequence of the blockade of our coast, the whole export of the United States amounted only to $6,927,441, of which $6,782,272 was of domestic produce, which found its way through certain ports, which, for a time, were not subject to the blockade.

The ratifications of peace were exchanged in February 1815. The stock of foreign commodities having been nearly exhausted, great importations immediately ensued. The exportation of domestic commodities, though considerable, was much less in value. But in the following year there was a short harvest in England, and our exports of domestic produce in 1816, 1817 and 1818, exceeded those of any three previous years.

It was the opinion of many, that on the pacification of Europe, our commerce must become inconsiderable. Dr. Seybert, whose work was published in 1818, said, "we should refer to our experience, from 1783 to 1791, for the rules that seem best adapted to our future situation." These gloomy forebodings have not been verified. The following account of the exports of domestic produce, for periods of five years, from 1795 to 1829, shows a considerable increase since the close of the war.

From 1795 to 1799,	both inclusive,	$32,822,965
" 1800 to 1804,	"	42,048,366
" 1805 to 1809,	"	34,631,848
" 1810 to 1814,	"	30,618,194
" 1815 to 1819,	"	60,780,214
" 1820 to 1824,	"	48,606,904
" 1825 to 1829,	"	67,058,401

The period in which the exports were, apparently, of the most value, was from 1815 to 1819: but during part of this time specie payments were suspended in the United States, and during the whole of the time in England.

If due allowance be made for the fall of prices which has taken place since the resumption of specie payments in Europe and America, it will be found that there has been a considerable increase of our exports in the aggregate, though not an increase in proportion to the increase of population. In 1790, the value of our exports was in the proportion of $4.84 for each inhabitant. In 1801, the domestic produce exported was in the proportion of $8.92 for each inhabitant; in 1810, the proportion was $6.25; in 1829, it was $4.65.

Table 56 gives the value of the exports from 1790 to 1829, and of the imports from 1821 to 1829. The exports are valued according to the average price at the places of exportation. The imports are valued at the prices they bear at the places of purchase abroad, with the addition of twenty per cent to those imported from beyond the Cape of Good Hope, and of ten per cent to those imported from other places.

Table 57 shows the tonnage of the United States from 1789 to 1829, and also the proportion of foreign tonnage employed in the trade of the country in different years. From 1789 to 1792, the only account of tonnage kept at the treasury, was that on which the duties were collected, and which included the repeated voyages made by the same vessels in the course of the year. Since 1792, all vessels employed in the foreign trade have been *registered*, and those employed in the coasting trade and the coast fisheries have been *enrolled*, excepting vessels under twenty tons, which are *licensed.* Annual accounts of the vessels registered, enrolled, and licensed, are transmitted to the treasury department; but as the collectors frequently neglect to make due allowances for vessels worn out, lost at sea, or sold to foreigners, the returns in but few years give the exact amount of tonnage. In 1810, when the amount of tonnage returned was 1,424,783, Mr. Pitkin supposed the true amount to be 1,250,000. Through neglect of this kind, our tonnage appeared, from the returns, to be annually increasing from 1818 to 1829; but in the last mentioned year the records were examined, and it was found necessary to deduct upwards of 500,000 tons, on account of vessels lost at sea, condemned as unseaworthy, or sold to foreigners, in previous years, but of which no return had been made by the collectors of the customs.

From 1803 to 1812, the tonnage of newly built registered vessels amounted annually to 74,639 tons; that of enrolled to 28,172: total, 102,811. In 1829, the tonnage of newly built registered vessels was 28,876. In the same year, there were lost at sea, condemned as unseaworthy, or sold to foreigners, registered vessels of the burden of 35,037 tons, making a *decrease* in that year of 6,161 tons in registered vessels. The tonnage of enrolled and licensed vessels built in 1829, was 48,221 tons. The tonnage of vessels of these classes lost at sea or condemned as unseaworthy, in that year, was 8,203 tons, showing an increase of 40,018 tons, in vessels employed in the coasting trade and fisheries.

In 1810, our registered tonnage was about in the proportion of one ton to every 9 inhabitants of the United States. In 1829, it was in the proportion of one ton to every 19.2 inhabitants. When we consider the change that has taken place in the affairs of the world, and the many restrictions that have been imposed on American commerce, both at home and abroad, we cannot be surprised at the difference of these proportions.

The exports of the United States are classed, at the treasury department, as products of the sea, of the forest, of agriculture, and of manufactures. The value of the products of the sea, annually exported, has, of late years, amounted to little more than a million and a half of dollars: those of the forest to upwards of four millions: those of agriculture, between forty and fifty millions: of manufactures, to two or three millions, and, within a few years, to four or five millions. Table 58 contains a specification of the different articles included in each of these classes, and of their value at the place of export, for the year ending September 30, 1830.

Of agricultural products, the principal article of export is cotton. The value of this commodity exported in 1825, was $36,846,649; but this was owing to a rise of price abroad, produced by specula- [illegible] $31,334,000; 1819, $21,082,000; 1820, $22,309,000; 1821, $20,157,484; 1822, $24,035,058; 1823, $20,445,520; 1824, $21,947,401; 1825, $36,846,649; 1826, $25,025,214; 1827, $29,359,545; 1828, $22,487,229; 1829, $26,575,311; 1830, $29,674,883. More than two-thirds of the cotton exported is sent to Great Britain. France is our principal market for the residue.

Previous to the revolutionary war, tobacco constituted one-third or one-fourth of the whole export from the country. Of late years, it has constituted one-eighth or one-ninth. The value of this article exported in 1830, was $5,586,365. In no year since 1831, has it risen to seven millions; and in 1824, it fell below five millions. Of the tobacco exported in 1830, about $1,500,000 worth was to England; about $1,100,000 worth to the Netherlands; nearly one $1,000,000 worth to France; $750,000 worth to the Hanse towns; $439,000 to Spain; $123,000 to Sweden and Norway; and the residue to various countries.

The export of rice was, in 1818, $3,263,000. In the next year, it sunk to $2,143,000; in the next, to $1,715,000; and in 1821, it fell to $1,494,307. From thence till 1829, it rose gradually, the value of this article exported being, in 1822, $1,553,482; in 1823, $1,820,985; in 1824, $1,882,982; 1825, $1,925,245; 1826, $1,917,445; 1827, $2,243,908; 1828, $2,620,696; 1829, $2,514,370. In 1830, it sunk to $1,986,624. The principal markets for rice are—England, the Netherlands, France, Cuba, and the Hanse towns.

The export of flour has, within the last two years increased greatly. From 1822 to 1829, the exports were usually from 800,000 to 900,000 barrels, of which about one half was to the West Indies, more than one-fourth to South America, and the residue to various countries. In 1830 the export of flour amounted to 1,225,881 barrels; and in 1831, to 1,805,205. In the last mentioned year, 879,430 barrels were exported to Great Britain and Ireland; 150,645 to the British North American provinces; 371,876 to the West Indies; 319,616 to South America; and about 70,000 to various parts of Europe, Asia and Africa.

The imports of the United States have, during the last ten years, amounted to about eighty millions of dollars a year; but of this amount about twenty-four millions have been annually re-exported, leaving about fifty-six millions for domestic consumption. The principal imports of the United States are teas and silks, from China; woollen and cotton manufactures from England and the continent of Europe; manufactures of iron and other metals from England; of flax, from England, Germany and France; of wine and brandy from the north of Europe; of coffee, sugar and molasses from the West Indies, and hides from South America. In 1830, the importation of woollen manufactures amounted to about six millions of dollars; of cotton about eight millions; of silk, six millions; of flax, three millions; of hemp, one million; of iron, five millions five hundred thousand; of earthenware, one million; of wine and brandy, two millions; of teas, two millions five hundred thousand; molasses, one million; sugar, five millions and a half; of coffee, four millions; of spices, five hundred thousand; of fruits, five hundred thousand; of salt, six hundred thousand. A portion of all these was destined for re-exportation. In the two years 1829 and 1830, the value of foreign cottons re-exported exceeded four millions. An account, in detail, of all the articles imported into the United States would exceed our limits. As such as are not admitted free of duty are entitled to benefit of drawback, if re-exported within a limited time, nearly every product of every clime occasionally finds its way to the United States; but the principal trade is in the articles already enumerated.

Table 59 exhibits a view of the amount of the commerce of the United States with each foreign country. This commerce, with each country, is in every year liable to be affected by political changes; but under all circumstances, except those of open war between the two countries, the trade of the United States with Great Britain seems to be the most important. Next to that is the trade with France. The trade with the Netherlands is the third in importance of our European branches of commerce. That with the Hanse towns is the fourth. The trade with Spain, once so important, has become inconsiderable: and that with Portugal has dwindled to almost nothing. The trade with Russia, Prussia, Sweden and Denmark, has never been, in ordinary times, of great amount.

The trade to the West Indies is, in the aggregate, of more importance than the trade to any one country of Europe, England excepted. The trade to the single island of Cuba is of more importance than the trade to any of the countries of Europe, except England and France. The imports from the different West India isles amounted in the year 1830 to nearly eleven millions and a half. The exports directly to those islands exceeded nine millions and a half. To these should be added upwards of three millions and a half exported to the British Northern colonies, but destined ultimately to the West Indies. The West Indies are the natural commercial dependencies of the United States. A political connexion with them is not desirable. But it would be very conducive to our interests and theirs, and to that of the European countries which claim sovereignty over them, if all restrictions were removed from the trade of these islands with the western continent.

Our exports to the new American states, formerly colonies of Spain, in 1830, amounted to nearly eight millions. Our imports from the same countries exceeded nine millions. To these countries the exports were in 1819, only $206,777; in 1820, 241,193; in 1821 they rose to one million; in 1822 they amounted to nearly two millions and a half; and they have gradually risen to the present amount.

We have confined our attention, hitherto, to the foreign trade of the United States; not because it is the most important, but because we have no statistical details to show the extent of the coasting and inland trade. Of the extent of the coasting trade, we may have some notion by considering that the amount of tonnage it employs is but little less than that employed in the foreign trade; and that a vessel in the coasting trade makes many voyages while a vessel in the foreign trade makes but one. Of the extent of the inland trade we may form some conception, by considering the amount of wealth that is annually produced and consumed in the country. It has been ascertained by inquiry, that the expense of supporting paupers in the almshouses, is from forty to sixty dollars a year. The annual consumption of those who are not paupers, may then be safely set down at one hundred dollars, a year, on an average. This would require an annual production of wealth to the amount of $1,300,000,000, to satisfy the wants of the community. Only a part of this, however, enters into trade, for many American families consume most of what their own labour and their own farms produce. If only one-half of what is annually produced becomes the subject of exchanges, our internal trade must amount yearly to more than to six hundred millions: if three-fourths, to nearly a thousand millions. This is an estimate which can hardly be considered enormous, if, in addition to the amount of enrolled and licensed tonnage, we take into view the extent of our roads and canals; the facilities for trade afforded by our lakes and rivers; the variety of our soil and products; the science, skill, industry and enterprise of our countrymen; the manner in which foreign trade vivifies domestic, and the perfect freedom of intercourse which subsists among the different states composing our confederacy.

TABLE LIV.

An account of the value in sterling money, of the imports of the several Provinces under-mentioned in the year 1769.

	From Great Britain.	From the South of Europe.	From the West-Indies.	From Africa.	Total.
New-Hampshire,	223,695 11 6	652 7 6	48,528 18 7	180 0 0	564,034 3 8
Massachusetts,		21,908 5 6	155,337 1 4		
Rhode-Island,		2,580 19 6	56,839 17 3		
Connecticut,		267 5 3	53,993 17 3		
New York,	75,930 19 7	14,927 7 8	97,420 4 0	697 10 0	188,976 1 3
New Jersey,		326 18 2	1,663 19 9		1,990 17 11
Pennsylvania,	204,979 17 4	14,249 8 4	180,591 12 4		399,820 18 0
Maryland,	714,943 15 8	4,683 2 3	32,197 13 9	5,400 0 0	851,140 6 6
Virginia,		9,442 2 4	77,453 12 6	7,020 0 0	
North Carolina,	327,084 8 6	932 19 9	10,603 13 3	1,080 0 0	935,714 2 3
South Carolina,		6,166 6 1	65,666 4 8	124,180 10 0	
Georgia,	58,340 19 4	547 7 7	9,407 9 9	13,440 0 0	81,735 16 8
Total,	1,604,975 11 11	76,684 9 11	789,754 4 5	151,998 0 0	2,623,412 6 3

An account of the value in sterling money, of the exports of the several Provinces under-mentioned in the year 1769.

	To Great Britain.	To the South of Europe.	To the West-Indies.	To Africa.	Total.
New-Hampshire,	142,775 12 9	464 0 5	40,431 8 4	96 11 3	550,089 19 2
Massachusetts,		76,702 0 4	123,394 0 6	9,801 9 10	
Rhode Island,		1,440 11 0	65,206 13 2	7,814 19 8	
Connecticut,		2,567 4 5	79,395 7 6		
New York,	113,382 8 8	50,885 13 0	66,324 17 5	1,313 2 6	231,906 1 7
New Jersey,			2,531 16 5		2,531 16 5
Pennsylvania	28,112 6 9	203,752 11 11	178,331 7 8	560 9 9	410,756 16 1
Maryland,	759,961 5 0	66,555 11 11	22,303 9 2		991,401 18 6
Virginia,		73,635 3 4	68,946 9 1		
North Carolina,	405,014 13 1	3,238 3 7	27,914 7 9	71 15 4	569,584 17 3
South Carolina,		72,881 9 3	59,814 11 6	619 16 9	
Georgia,	82,270 2 3	614 2 0	13,285 15 1		96,169 19 4
Total,	1,531,516 8 6	552,736 11 2	747,910 3 7	20,278 5 1	2,852,441 8 4

TABLE LV.

An account of the principal articles exported from all the British Continental Colonies, including the islands of New Foundland, Bahama, and Bermuda, with the places to which they were sent, and their official value, at the ports of exportation, during the year 1770.

Species of Merchandize.		To Great Britain.	To Ireland.	To the South of Europe.	To the West Indies.	To Africa.	Totals.	
							Quantity.	Value in sterling money.
Pot ashes,	tons	1,173					1,173	£ 35,191 18 7
Pearl do.	"	737					737	29,468 10 7
Sperm. candles,	lb.	4,865	450	14,167	351,625	7,905	379,012	23,688 4 6
Tallow do.	"			1,630	57,550	240	59,420	1,237 18 4
Coals,	chaldron				20		20	25 0 0
Castorium,	lb.	7,465					7,465	1,679 12 6
Fish, dried,	quintals	22,086	450	431,386	206,081		660,003	375,393 17 0
Fish, pickled,	bbls.	123	25	307	29,582	31	30,068	22,551 7 6
Flax-seed,	bushels	6,780	305,083	749			312,612	31,168 18 1

TABLE LV.—Continued.

Species of Merchandize.	To Great Britain.	To Ireland.	To the south of Europe.	To the West Indies.	To Africa.	Totals.	
						Quantity.	Value in sterling money.
Indian corn, bushels		150	175,221	402,958	20	578,349	43,376 4 2
Oats, "			3,421	21,438		24,859	1,242 19 0
Wheat, "	11,739	149,985	588,561	955		851,240	131,467 0 10
Peas and beans, "			1,046	49,337		50,383	10,076 12 0
Ginseng, lb.	74,604					74.604	1,243 8 0
Hemp, tons	86					86	129 11 3
Iron, pig, "	5,747	267				6,017	30,088 10 0
Do. bar, "	2,102	85	273	3		24,064	36,960 17 3
Do. cast, "				2		2	32 13 11
Do. wrought, "				8		8	167 7 1
Indigo, lb.	584,593			83		584,672	131,552 2 0
Whale oil, tons	5,202	22	175	268		5,667	83,012 15 9
Do. fins, lb.	112,971					112,971	19,121 7 6
Linseed oil, tons	161			7		168	487 18 3
Copper ore, "	41					41	853 13 0
Lead ore, "	6					6	82 10 0
Bread and Flour "	263	3,583	18,501	23,449	72	45,868	504,553 6 1
Meal, bushels				4,430		4,430	443 0 0
Potatoes, "				3,382		3,382	126 16 6
Beef and pork, barrels			244 tons	2,870			66,035 1 10
Butter, lb.				167,313	300	167,613	3,491 18 9
Cheese, "				55,997			933 5 3
N. England rum, gall.	600	7,931	45,310	2,574	292,966	349,281	21,836 0 0
Rice, barrels	74,073		36,296	40,033	117	150,529	310,692 15 0
Rough rice, bushels				8,200			615 9 0
Amer. loaf sugar, lb.			600	8,548	1,500	10,648	332 15 0
Raw silk, "	541					541	541 11 [illegible]
Soap, "			550	85,035	1,000	86,585	2,164 12 6
Shoes, pairs				3,149		3,149	393 12 6
Ship stuff, barrels			7,327	640		7,964	9,958 15 0
Onions, value			£116 13 4	£6,378 16 1			6,495 9 5
Pitch, barrels	8,265			822	57	9,114	3.200 8 0
Tar, common, "	78,115			3,173	134	81,422	24.426 12 0
Tar, green, "	653					653	261 4 0
Turpentine, "	15,125			1,807	82	17,014	6,805 12 0
Rosin, "	195			28		223	278 15 0
Oil of turpentine, "	11			30		41	102 10 0
Masts, yards, &c. tons	3,043			2		3.045	16,630 0 0
Walnut wood, value	£105 15 11	9 0 0					114 15 11
Pine, oak, cedar bds, ft	6,013,519	329,741	486,078	35,922,168	4,800	42,756,306	58,617 15 10
Pine timber, tons	10,582	50	64	315		11.011	4,404 14 5
Oak timber, "	3,710	10	10	144		3,874	3,487 8 2
Houses, framed, No.				163		163	3,260 0 0
Staves and heading, "	4,921,020	2,828,762	1,680,403	11,116,141		20,546,326	61,618 19 5
Hoops, "	18,912		7,072	3,817,399	8,500	3,852,383	8,667 16 8
Shook hogsheads, "			549	62,099	30	62.678	7.834 15 0
Cattle, "				3,184		3,184	14,328 0 0
Horses, "				6,692			60,228 0 0
Sheep and hogs, "				12,797			4,478 19 0
Poultry, dozens				2,615		2,615	1,177 1 0
Furs, value	£91,485 14 9						91,485 14 9
Deer skins, lb.	799,652	185				799,652	57.738 19 7
Tobacco, value	£904,981 14 0			1,569 0 4	87 3 9		906.637 18 1
Tallow and lard, lb.	800			183,893	450	185,143	3.857 2 11
Bees wax, "	62,794	10,980	50,529	1,820	2,400	128,523	6.425 3 0
Total value of articles shipped as Amer. produce,	£1,686,654 4 6	114,078 13 6	685,920 6 4	844,178 14 9	21,381 16 6		3.356,159 10 2
Foreign merchandize, mostly from the West Indies,	£65,860 6 9	4,698 5 10	5,991 17 1	4,754 16 0	296 12 0		81.554 17 0
Total exports,	£1,752,514 11 3	118,776 19 4	691,912 3 5	848,933 10 9	21,678 8 6		3,437,714 7 2

TABLE LVI.

EXPORTS AND IMPORTS.

Table of the Value of the Exports and Imports of the United States, for the following years, ending respectively on the 30th September, together with a column showing the Population, as ascertained at the different periods when a Census was taken.

Year.	Articles, the growth, produce, or manufacture, of the United States, Exported.	Articles, the growth, produce, or manufacture of for. countries, Re-Exported	Total value of Exports from the U. States	Total Value of Imports into the U. States from foreign countries.	Population of the United States, according to the official Census.
1790	[Previous to 1796, the returns do not discriminate between domestic & foreign productions.]		20,205,156		3,921,426
1791			19.012,041		
1792			20,753,098		
1793			26,109,572		
1794			33,026,233		
1795			47,989,472		
1796	40,764,097	26,300,000	67,064,097		
1797	29,850,206	27,000,000	56,850,206		
1798	28.527,097	33,000,000	61.527,097		
1799	33,142,522	45,523,000	78,665,522		
1800	31,840,903	39,130,877	70,971,780		5,319,762
1801	47,473,204	46,642,721	94,115,925		
1802	36,708,189	35,774,971	72,483,160		
1803	42,205,961	13,594,072	55,800,033		
1804	41,467,477	36,231,597	77,699,074		
1805	42,387,002	53,179,019	95,566,021		
1806	41,253,727	60,283,236	101,536,963		
1807	48,699,592	59,643,558	108,343,150		
1808	9,433,546	12,997,414	22,430,960	Period embracing the embargo, non importation, and non intercourse l'ws & the war.	
1809	31,405,702	20,797,531	52.208,233		
1810	42,366,675	24,391,295	66,757,970		7,230,903
1811	45,294,043	16,022,790	61,316,833		
1812	30,032,109	8,495,127	38,527,236		
1813	25,008,152	2,847,845	27,855,997		
1814	6.782.272	145,169	6,927,441		
1815	45 974,403	6,583,350	52,557,753		
1816	64,781,896	17,138,556	81,920,452	[Prev. to Oct. 1, 1820, the returns don't show the val. of Imports.]	
1817	68,313,500	19,358,069	87,671,569		
1818	73,854,437	19,426,696	93,281,133		
1819	50,976,838	19,165,683	70,142,521		
1820	51,683,640	18,008,229	69,691,669		9,637,999
1821	43,671,894	21,302,488	64,974,382	62,585,724	
1822	49,874,079	22,286,202	72,160,281	83,241,541	
1823	47,155,409	27,543,622	74,699,030	77,579,267	
1824	50,649,500	25,337,157	75,986,657	80,549,007	
1825	66,944,745	32,590,643	99,535,388	96,340,075	
1826	53,055,710	24,539,612	77.595,322	84,974,477	
1827	58,921,691	23,403,136	82,324,827	79,484,068	
1828	50,669,669	21.595.017	72,264,686	88,509,824	
1829	55,700,193	16.658,478	72,358,671	74,492,527	
1830	59,462 029	14.337,479	73,399,508	70,876,920	12,788,742
1831	61,277,057	20,033,526	81,310.583	103,191,124	

Note.—The estimate for the year 1790 is from the 1st of Aug. 1789.

TABLE LVII.

TONNAGE.

Table of the Tonnage of the Shipping of the United States, from the year 1789 to the year 1829—omitting the fractions of a ton.

Year.	Registered.	Enrolled and Licensed.	Total.
1789	123,893	77,669	201,562
1790	346,254	132,123	478,377
1791	363,110	139,036	502,146
1792	411,438	152,999	564,437
1793	367,734	124,046	491,780
1794	438,862	189,954	628,816
1795	529,470	218,493	747,963
1796	576,733	255,167	831,900
1797	597,777	279,135	876,912
1798	603,376	294,952	898,328
1799	669,197	277,211	946,408
1800	669,921	302,571	972,492
1801	718,549	314,669	1,033,218
1802	560,380	331,721	892,101
1803	597,157	351,990	949,147
1804	672,530	369,873	1,042,403
1805	749,341	391,027	1,140,368
1806	808,284	400,451	1,208,735
1807	848,306	420,242	1,268,548
1808	769,053	473,542	1,242,595
1809	910,059	440,222	1,350,281
1810	984,269	440,514	1,424,783
1811	768,852	463,650	1,232,502
1812	760,624	509,373	1,269,997
1813	674,853	491,775	1,166,628
1814	674,632	484.576	1,159,208
1815	854,294	513,833	1,368,127
1816	800,759	571,458	1,372,218
1817	809,724	590,186	1,399,911
1818	606,088	609,095	1,225,184
1819	612,930	647,821	1,260,751
1820	619,047	661,118	1,280.166
1821	619,096	679,062	1,298.958
1822	628,150	696.548	1,324,699
1823	639,920	696,644	1,336,565
1824	669.972	719,190	1,389,163
1825	700,787	722.325	1,423,111
1826	737,978	796,212	1,534,190
1827	747,170	873.437	1,620,607
1828	812,619	928,772	1,741,391
1829	650,142	610,654	1,260,797

Note.—This table includes steamboats and all the vessels employed in foreign commerce, the coasting trade, and the fisheries.

TABLE LVIII.

Summary Statement of the value of the exports of the growth, produce, and manufacture of the United States, during the year commencing on the 1st October, 1829, and ending on the 30th September 1830.

THE SEA.	*Dollars.*	*Dollars.*	*Dollars.*
Fisheries—			
Dried fish or cod fisheries		530,690	
Pickled fish or river fisheries, herring, shad, salmon, mackerel		225,987	
Whale and other fish oil . . .		568,326	
Spermaceti oil		38.618	
Whalebone		112,357	
Spermaceti candles		249,292	
			1,725,270
THE FOREST.			
Skins and furs		641.760	
Ginseng		67,852	
Product of wood—			
Staves, shingles, boards, and hewn timber .	1,501,658		
Other lumber	148,257		
Masts and spars	13.327		
Oak bark and other dye . . .	220.275		
All manufactures of wood . . .	172.772		
Naval stores, tar, pitch, rosin, and turpentine	321.019		
Ashes, pot and pearl	1,105,127		
		3,482,435	
			4,192,004
AGRICULTURE.			
Product of animals—			
Beef, tallow, hides, and horned cattle .	717,683		
Butter and cheese	142,370		
Pork (pickled), bacon, lard, live hogs .	1,315,245		
Horses and mules	182,244		
Sheep	22.110		
		2,379,652	
Vegetable food—			
Wheat	46,176		
Flour	6,085.953		
Indian corn	224.823		
Indian meal	372.296		
Rye meal	87,796		
Rye, oats, and other small grain and pulse .	66.249		
Biscuit or ship bread . . .	188,474		
Potatoes, ...	39.027		
Apples	23,727		
Rice	1,986,824		
		9,121,345	
			11,500,997
Tobacco			5,586.365
Cotton			29,674,883
All other agricultural products			
Indigo		827	
Flaxseed		180.973	
Hops		30.312	
Brown sugar		2,975	
			215,087
MANUFACTURES.			
Soap and tallow candles		619.238	
Leather boots and shoes		338,603	
Household furniture		239,463	
Coaches and other carriages		51,190	

TABLE LVIII.—Continued.

MANUFACTURES.	*Dollars.*	*Dollars.*	*Dollars.*
Hats		309,362	
Saddlery		36,651	
Wax		153,666	
Spirits from grain, beer, ale and porter		225,357	
Snuff and tobacco		246,747	
Lead		4,831	
Linseed oil, and spirits of turpentine		35,039	
Cordage		4,135	
Iron, pig, bar, and nails		96,189	
castings		35,408	
all manufactures of		177,876	
Spirits from molasses		49,798	
Sugar, refined		193,084	
Chocolate		893	
Gunpowder		128,625	
Copper and brass		36,601	
Medicinal drugs		92,154	
			3,074,910
Cotton piece goods—			
Printed and coloured	61,800		
White	964,196		
Nankeens	1,093		
Twist, yarn, and thread	24,744		
All other manufactures of	266,350		
		1,318,183	
Flax and hemp—			
Cloth and thread		2,152	
Bags, and all manufactures of		1,779	
Wearing apparel		102,277	
Combs and buttons		124,589	
Brushes		6,116	
Billiard tables and apparatus		316	
Umbrellas and parasols		25,796	
Leather and morocco skins, not sold per pound		70,968	
Printing presses and type		13,274	
Musical instruments		10.261	
Books and maps		32.004	
Paper and other stationary		40.994	
Paints and varnish		13.716	
Vinegar		6,690	
Earthen and stoneware		2,773	
Manufactures of glass		60,280	
tin		4,497	
pewter and lead		4,172	
marble and stone		4,655	
gold and silver and gold leaf		3,561	
Gold and silver coin		937,151	
Artificial flowers		13,707	
Molasses		3,968	
Trunks		6,654	
Brick and lime		2,482	
Salt		22,978	
			2,835,993
Articles not enumerated—			
Manufactured		347,228	
Other		309,249	
			656,477
			59,462,029

TABLE LIX.

View of the Commerce of the U. S. with different Foreign Countries, during the year ending Sept. 30, 1831.

COUNTRIES.	COMMERCE.				NAVIGATION.			
	VALUE OF IMPORTS.	VALUE OF EXPORTS.			AMER. TONNAGE.		FOREIGN TONNAGE.	
		Domestic produce.	Foreign produce.	Total.	Entered into U. S.	Departed from U.S.	Entered into U.S.	Departed from U.S.
	Dollars.				Tons.			
Russia	1,621,899	35,461	381,114	416,575	13,681	3,492	264	264
Prussia	16,605	16,501		16,501	372	232		
Sweden and Norway . .	1,168,110	181,353	189,949	371,302	15,144	3,502	2,935	2,023
Swedish West Indies . .	230,536	552,700	37,727	590,427	10,406	19,960	965	984
Denmark . . .	5,384	76,292	29,048	105,340	877	1,923		
Danish West Indies . .	1,665,834	1,638,022	220,723	1,908,745	38,767	52,535	600	849
Netherlands . . .	888,408	3,354,551	675,527	4,030,078	42,998	35,220	793	4,515
Dutch East Indies . .	181,848	63,273	107,293	170,566	662	1,501		220
Dutch West Indies . .	286,509	319,495	42,298	361,793	12,047	11,043	243	124
England . . .	22,755,040	23,773,020	826,946	24,599,966	199,972	192,714	61,355	58,589
Scotland . . .	1,382,841	1,465,211	2,488	1,467,699	5,784	6,913	12,560	7,707
Ireland	381,333	261,687		261,687	5,494	4,594	6,949	2,570
Gibraltar . . .	90.028	513,248	370,150	883,398	3,346	13,450		
British East Indies . .	1,373,297	93,731	553,126	646,857	4,806	4,029		
British West Indies . .	168,579	140	1,761	1,901	22,428	2,395	275	
Newfoundland . . .					452	1,523		
British American Colonies .	650,303	3,650,031	136,342	3,786,373	130,527	117,171	4,002	14,267
British African ports . .	2,300					510		
Other British colonies .	1,263				396			
Hanse Towns . .	1,873,278	1,549,732	725,148	2,274,880	17,259	14,728	8,488	10,252
France on the Atlantic .	6,831,015	9,183,894	661,925	9,845,819	79,459	82,521	4,061	6,014
France on the Mediterranean .	891,183	717,252	430,888	1,148,140	15,406	18,957	205	1,074
French West Indies . .	518,687	792,241	13,528	805,769	25,928	47,129	5,945	4,325
French African ports . .		5,931	579	6,510		106		
Spain on the Atlantic . .	461,267	538.956	61,327	600,283	16,288	9,387		
Spain on the Mediterranean .	543,271	145,556		145,556	10,920	3.017		
Teneriffe, and other Canaries .	99,878	19,040	610	19,650	1,762	796		
Manilla, and Philippine Islands	384,887	39,129	54,559	93,668	2,774	458	122	
Cuba	5,577,230	3,439,060	1,477,675	4,916,735	97,644	114,054	12,954	11,356
Other Spanish West Indies .	1,307,148	245,636	27,523	273,159	19,031	8,734	625	489
Portugal	165,321	43,408	1,803	45,211	12,287	2,243		184
Madeira	239,652	155,719	12,358	168,077	3,212	6,080	114	
Fayal, and other Azores .	32,912	6,649	1,524	8,173	634	244	137	137
Cape de Verd islands . .	33,758	50,560	7,778	58,338	1,253	2,628		
Italy	940,254	326,239	414,121	740,360	5,062	6,626		418
Sicily	3,740				1,697	135		
Trieste, and other Adriatic ports	132,093	300,859	293,261	594,120	4,332	4,662		282
Ragusa, and the Seven Islands					345			
Turkey, &c. . . .	417,392	75,801	337,539	413,340	3,668	2,887		
Hayti	1,597,140	714,791	108,387	823,178	13.513	19,395	1,633	1,748
Mexico	5,235,241	985,764	3,851,694	4,837,458	22,062	27,295	4,362	3,551
Central Republic . .	302,833	138,456	111,662	250,118	4.560	3,044		
Colombia	1,120,095	316,732	180,258	496,990	13,514	5,955	1,076	62
Honduras	1,472	25,132	5,432	30,564	68	1,042		
Brazil	2,491,460	1,600,999	242,239	1,843,238	38,005	44,450	248	601
Argentine Republic . .	1,431,883	425,220	204,667	629,887	6,584	9,565	225	116
Cisplatine Republic . .					236	1,373		
Chili	182,585	915,718	620,396	1,536,114	304	12,287		
Peru	972,884	32,400	39,402	71,802	3,276	732		
South America, generally .	40,269	9,190	170	9,360	394	679		155
China	3,878,141	156,290	585,903	742,193	8,598	3,501		
Asia, generally . . .	98,451	56,318	229,290	285,608	1,679	3,697		
West Indies, generally .	7,386	242,114	5,010	247,124	2,288	7,417		260
East Indies, generally .						424		
Europe, generally . .	394	16,090	22,653	38,743	1,904	911	141	
Africa, generally . .	172,861	96,867	52,236	149,103	2,730	2,560	618	290
Cape of Good Hope . .						580		
South Seas . . .	20,748	21,178	6,764	27,942	15,392	28,222		
Northwest coast of America .		28.392	24,698	53,090		522		
Total	70,876,920	59,462,029	14,387,479	73,849,508	967,227	971,760	131,900	133,436

TABLE LX.

Statement of the Commerce of each State and Territory, commencing on the 1*st day of October* 1829, *and ending on the* 30*th day of September* 1830.

STATES AND TERRITORIES.	VALUE OF IMPORTS.			VALUE OF EXPORTS.						
				Domestic produce.			Foreign produce.			Total value of domestic and foreign produce.
	In American Vessels.	In foreign vessels.	Total.	In American vessels.	In foreign vessels.	Total.	In American vessels.	In foreign vessels.	Total.	
Maine	555,036	17,630	572,666	640,146	3,289	643,435	27,087		27,087	670,522
N. Hampshire	130,828		130,828	93,499		93,499	2,685		2,685	96,184
Vermont	140,059		140,059	658,256		658,256				658,256
Massachusetts	10,345,947	107,597	10,453,544	3,548,910	51,042	3,599,952	3,566,137	47,105	3,613,242	7,213,194
Rhode Island	488,756		488,756	206.965		206,965	71,985		71,985	278,950
Connecticut	269,583		269,583	385,610		385,610	3,901		3,901	389,511
New York	33,432,098	2,191,972	35,624,070	12,277,553	1,340,725	13,618,278	5,130,189	949,516	6,079,705	19,697,983
New Jersey	13,444		13,444	8,224		8,224	100		100	8,324
Pennsylvania	8,594,297	107,825	8,702,122	2,763,229	161,223	2,924,452	1,303,115	64,226	1,367,341	4,291,793
Delaware	26,062	512	26,574	52.258		52,258				52,258
Maryland	4,358,473	165,393	4,523,866	2,829,177	246,808	3,075,985	680,099	35,398	715,497	3,791,482
D. of Columbia	168,550		168,550	746,591		746,591	7,382		7,382	753,973
Virginia	385,719	20,020	405,739	4,557,667	231,137	4,788,804	1,767	713	2,480	4,791,644
North Carolina	213,841	8,151	221,992	363,219	35,331	398,550	783		783	399,333
South Carolina	747,789	306,830	1,054,619	5,517,708	2,063,113	7,580,821	24,290	21,920	46,210	7,627,031
Georgia	164,598	117,838	282,436	4,566,910	769,716	5,336,626				5,336,626
Alabama	83,908	60,915	144,823	1,822,069	469,756	2,291,825	3,129		3,129	2,294,594
Mississippi										
Louisiana	5,873,970	1,725,113	7,599,083	10,059,640	2,983,100	13,042,740	1,953,880	492,072	2,445,952	15,488,692
Ohio	78	84	162							
Michigan Ter.	20,904	411	21,315	1,588		1,588				1,588
Florida Ter.	21,799	10,890	32,689	6,970	600	7,570				7,570
Total	66,035,739	4,841,181	70,876,920	51,106,189	8,355,840	59,462,029	12,776,529	1,610,950	14,387,479	73,849,508

STATES AND TERRITORIES.	NAVIGATION.					
	Quantity of Amer. tonnage.		Quantity of foreign tonnage.		Total Amer. & for. tonnage.	
	Entered.	Departed.	Entered.	Departed.	Entered.	Departed.
Maine	69,363	91,629	5,378	6,165	74,741	97,794
New Hampshire	9,416	4,632			9,416	4,632
Vermont	29,741	19,290			29,741	19,290
Massachusetts	168,243	148,124	4,663	5,176	172,906	153,300
Rhode Island	16,676	14,094			16,676	14,094
Connecticut	16,171	18,285		77	16,171	18,362
New York	298,434	229,341	35,344	36,574	333,778	265,915
New Jersey	586	627			586	627
Pennsylvania	72,009	63,022	5,007	4,870	77,016	67,892
Delaware	1,691	962	141	141	1,832	1,103
Maryland	55,317	55,020	6,315	3,836	61,632	58,856
District of Columbia	10,458	13,803			10,458	13,803
Virginia	25,997	43,715	2,833	4,305	28,830	48,020
North Carolina	27,757	36,592	1,770	1,772	29,527	38,364
South Carolina	50,859	52,464	21,760	20,405	72,619	72,869
Georgia	19,249	50,394	8,103	9,485	27,352	59,879
Alabama	10,490	22,277	4,826	4,059	15,316	26,336
Mississippi						
Louisiana	83,270	106,017	35,393	36,317	118,663	142,334
Ohio	56	56	49	49	105	105
Michigan Territory		50				50
Florida Territory	1,444	1,366	318	205	1,762	1,571
Total	967,227	971,760	131,900	133,436	1,099,127	1,105,196

MANUFACTURES.

The London company which began the colonization of Virginia, gave considerable attention to manufactures. Among the establishments at Jamestown, were glass-works, for making beads for the Indian trade. At Falling Creek were iron-works. At Cape Charles, on the eastern shore of Virginia, were salt-works. The cultivation of the virgin soil was so much more profitable than the making of iron, glass and salt, that it can excite no surprise to hear that these works, all of which had their origin previous to the year 1616, were not long continued in operation. Those branches of manufactures which are included under the general name of handicrafts, were better adapted to the condition of the colonists, and most of these were successfully prosecuted by them from a very early period of our country's history.

The inhabitants of the colonies in 1700, ninety-three years after the commencement of the settlement of Virginia, and eighteen years after the foundation of Philadelphia, were only 262,000, or but 50,000 more than the city of New York now numbers. This small population, scattered over a territory many hundred miles in extent, found in agriculture, navigation, commerce and the fisheries, their principal means of subsistence. From the land and the ocean they drew that which enabled them to procure from Europe many of the comforts of life, at less cost than they could produce them at home. But though they enjoyed, by law, a free trade with the British West Indies, and without law, a free trade with the other West Indies, and many other parts of the world, their agriculture, commerce, navigation, and fisheries, did not afford full employment for their labour and capital. An English author who wrote at the period to which we are now referring, says the colonists made much of their own clothing, *because* what raw produce they sold in the West Indies and in Europe, was not sufficient to procure them all the manufactures they needed.

That they had at this time carried some branches of manufacturing to a considerable extent, we have incidental proof in a law passed by parliament in 1699, intended principally to restrict the commerce of Ireland, but the provisions of which were extended so as to include that of America. "Complaints," says a historian, "being still loud concerning the wool and woollen manufactures of Ireland exported into foreign parts; and that even those of our North American plantations began to be likewise exported to foreign markets, formerly supplied by England," a law was passed by which it was declared, "no wool, nor manufactures of wool shall be exported from Ireland to any port of the world but to England, under forfeiture of ships and cargoes, and also of five hundred pounds penalty. The like forfeitures are hereby inflicted on such as shall export in ships, or shall carry by horses, into any other place or colony *out* of the king's dominions, any wool or woollens of the English plantations in America."

It is not likely that the Americans could have much woollen cloth of their own manufacture for exportation, at a period when they were under the necessity of devoting much of their labour and capital to the clearing of new lands, and when there was a great demand in the West Indies and in Europe for the products of their agriculture and of their fisheries. But this law is proof that the manufacture of woollen had, at that early day, become important enough to excite the jealousy of the British, a jealousy, it must be confessed, very easily excited.

The next instance we have met with of strongly marked jealousy of American manufactures, was in 1715. It appears then to have been awakened by the remarks of a New England man, possibly one who had profited by the bounty granted in 1703, on American naval stores, imported into Great Britain. In a letter addressed to the Board of Trade and Plantations, he urges the propriety of continuing this bounty. "Our country," he says, "abounds in iron ore; but we have not yet got into the way of making enough for our own supply. *Wherefore*, to prevent our setting up in New England, manufactures that will interfere with Great Britain, it is highly necessary to employ the New England people as much as possible in making naval stores for their mother country." In the same letter he says, "that in the scarcity or dearness of woollen goods from England about nine years ago, the New England people, not being able to pay two hundred per cent and more advances thereon, did set up a very considerable manufacture, still in being, for stuffs, kerseys, linsey-woolseys, flannels, buttons, &c."

By this time, iron works had been re-established in Virginia, and were in successful operation. That the manufacture of iron was carried to some extent, on other parts of the continent, is implied in the remark of the New England man, "we have not *yet* got into the way of making *enough* for our own supply."

The policy which this New Englandman delineated, the British government was not indisposed to observe: and in 1719, a bill was brought into parliament to extend the bounty granted on tar and pitch, and ship-timber, to all sorts of timber imported from the colonies: but this bill had in it a clause, "that none in the plantations should manufacture iron wares of any kind whatever, out of any sows, pigs, or bars whatsoever;" to which the House of Peers added a provision, "that no forge, going by water or other work whatsoever, should be erected in any of the said plantations, for the making, working, or converting of any sows, pigs, or cast iron, into bar or rod iron." "By the first clause," says a writer who took the side of the colonists, "no smith in the plantations might make so much as a bolt, spike, or nail; whereby the colonies must have been brought into a miserable condition, the smith being, above all other trades, absolutely necessary there. Amongst the rest, that of shipbuilding would have hereby been utterly destroyed, although by that article they make a great part of their returns for the purchase of British manufactures." "The second clause," says the same author, " must have ruined all the iron works in the colonies, to the great loss of the proprietors."

The bill was not passed; but the principles on which it was founded had their influence even on those who opposed it, for we find the same author who was so reasonable in regard to iron, contending, " that negro slaves in our plantations should not be permitted to work in manufactories there (as certainly many do) but to keep them to their original intent of planting and drudging: and also, that the increase of woollen, &c. manufactures there, interfering with those of our own, should be restrained as much as possible."

In 1722, a bill was passed extending the bounties on pitch and tar, and granting new bounties on timber imported from the colonies, without the objectionable clause contained in the bill of 1719.

By such means as these, the British legislature hoped to divert the attention of the Americans from manufactures; but, from the cause to which they owed their origin, viz. the impossibility of finding profitable employment for all their labour and capital in agriculture and navigation, American manufactures continued to advance. " Soap, candles, starch, hair-powder, tanned leather, linseed oil, strong waters, and strong beer," are enumerated among the ordinary exports from Pennsylvania and some of the adjoining colonies, in 1731. The building of ships for sale in foreign ports was a regular employment. At this early period, the Pennsylvanians alone appear to have built yearly about 2000 tons of shipping, for sale abroad: and the New Englandmen carried on the business on a more extensive scale.

For some years the British manufacturers supplied the Americans with many of the hats they used: but at the time of which we are now speaking, the manufacture of hats in America was carried so far, that considerable quantities were exported to Spain, Portugal, and the West Indies. " The conveniences in point of cheapness which the Americans have beyond the mother country, by the plenty of beaver, hare, coney wool, and many other furs, gave them such advantages," says a British author, " that had they not been restrained, they would soon have supplied all the world with hats." This was rather hyperbolical: but the rival spirit of trade is apt to magnify the dangers arising from free competition: and, in 1732, an act of parliament was passed, declaring, " that no hats or felts whatever shall be exported from any of the said plantations to foreign parts, nor shall be laden on any horse, cart, or other carriage, with that intent, under forfeiture thereof, and a fine of five hundred pounds for every such offence; and aiders and abettors therein shall forfeit forty pounds: and custom-house officers permitting entries of such hats to be made, shall forfeit their office and five hundred pounds. None shall make hats in the said colonies but such as shall have served an apprenticeship thereto of seven years. And no master shall have, at any time, above two apprentices; nor shall he employ any negro in that manufacture."

These were severe measures; but we can hardly wonder at their being adopted by a government which in 1721, only eleven years before, had passed an act, " for employing the manufacturers, and encouraging the consumption of raw silk and mohair yarn:" by which act, the wearing of buttons or button-holes made of cloth or other stuff, was absolutely prohibited to the people of England!

A report made by the Board of Trade, in 1732, exhibits, in a strong light, the jealousy with which the British regarded American manufactures; and the caution of the Americans not to rouse that jealousy. To the queries forwarded by the Board of Trade, the governors of the different provinces gave very guarded, and, in some cases, very indefinite answers. When the fact of a manufacture's being established was too notorious to be passed over, they gave such representations as they deemed fit for lulling suspicion that it might interfere with British industry, or apologized for its existence by stating, that without it the people would be without employment, or the means of paying for their importations from Great Britain. The reply from New York was, " they had no manufactures in that province that deserved mentioning." Similar replies were received from several other colonies. The governor of Massachusetts was forced to confess that the inhabitants of some parts of that province worked up their wool and flax into " an ordinary coarse cloth" for their own use; and that there were also a " few" hatters set up in the maritime towns: but he represented the manufacture of iron as quite insignificant.

The Board of Trade had, however, other correspondents in America, and these gave, in some cases, directly opposite statements to those made by the governors. The surveyor general of his majesty's woods wrote, that they had, in New England, six furnaces and nineteen forges for making iron. From another source, the Board learned, that great quantities of hats were exported from New York, the province which, according to the reply given by its governor, " had no manufactures that deserved mentioning." The governor of Pennsylvania had been bold enough to assert, that the Pennsylvanians had " *no* manufactures established: their clothing and utensils for their houses being *all* imported from Great Britain." The deputy governor, when subsequently applied to, could not sustain this representation; but he evinced the same feelings as his principal. He writes, says the Board of Trade, that " *he does not know* of any trade carried on in that province that can be *injurious* to this kingdom: and that they do not *export* any woollen or linen manufactures; all that they make, which are of a coarse sort, being for their own use."

From a comparison of the different statements, it is evident that the Americans, at that time (a century ago, and when the population of the country amounted to hardly one million), worked up all the wool they raised, and nearly, if not quite, all the flax, into coarse cloths for family use; that they had some manufactures of hemp; that nearly all the leather they used was manufactured by themselves; that the manufacture of iron was increasing; that the Pennsylvanians, in addition to the wool and flax they raised themselves, manufactured a part of what was raised in Virginia and Maryland; that the manufacture of fine linen had been introduced into New

Hampshire by emigrants from Ireland; that they had sugar-bakeries and distilleries in New England; that in Massachusetts they had some furnaces for cast iron or hollow ware, one slitting mill, and a manufactory of nails; that some duck or canvass was manufactured by the people of that province; that they made brown hollands for women's wear, "which lessened the importation of calicoes and some other sorts of East Indian goods;" that they also made some "small quantities of cloth of linen and *cotton*, for ordinary shirting and sheeting;" and that, by a paper mill, set up about the year 1729, they made paper to the value of two hundred pounds yearly.

This early establishment of the manufacture of fine paper is truly remarkable, as, till the year 1690, "there was," says a British historian, "scarce any other kind of paper made in England but the coarse brown sort." The Board of Trade did not complain of the fine paper of Massachusetts, as interfering with the business of the British manufacturer; but "as interfering with the profit made by the British merchant on foreign paper sent thither, being almost the only sort of paper sent thither."

About the year 1740, the Carolinians had carried the cultivation of rice to such a height, that in time of peace they overstocked the markets to which they were wont to send it. The case was still worse when the war with France broke out in 1743, by reason of the high freight and insurance. This induced the planters to try to employ their negroes in several new manufactures of linen, woollen, and other things, which they were before accustomed to take from Great Britain. The introduction of the culture of the indigo plant, which occurred a year or two after, gave them more profitable employment.

In the year 1750, an act of parliament was passed, "to encourage the importation of pig and bar iron from his majesty's colonies in America, and to prevent the erection of any mill or other engine for slitting or rolling iron, or any plating forge to work with a tilt-hammer, or any furnace for making of steel, in any of the said colonies."

The enactments respecting woollens, hats, and iron, appear to have been the only direct attempts made by the British government to retard the progress of manufactures in America. Instead of marvelling at their having been adopted, let us rather marvel that a government which heaped piles of regulations on nearly every branch of the industry of the people of England, should have imposed so few restraints on this department of colonial enterprise. It was British policy rather to *divert* the attention of the Americans from manufacturing pursuits, by granting a bounty on many kinds of raw produce, when imported into Great Britain. Perhaps these bounties were regarded by our ancestors as a compensation for the restrictions on manufactures. Whatever the cause may have been, the restrictions on manufactures appear to have produced less feeling than the restraints on commerce; but, from the evidence they on various occasions gave of their spirit, we may rest assured, that if the Americans of that day did not break through these restrictions, it was only because they could import all the more refined or more advanced manufactures cheaper than they could make them at home. As a drawback was allowed on the exportation from England of the greater part of foreign goods, many of the manufactures of the continents of Europe and Asia could be bought cheaper in America than in England.

The acts of 1764, by abolishing in some cases, and diminishing in others, the drawbacks on goods exported from England to the colonies, had a tendency to raise the prices of many articles in America, but less on account of this rise of price, than to show their dissatisfaction with the policy of the mother country, and to retaliate on her the evils they suffered through restrictions on trade, the Americans made considerable efforts to introduce new manufactures, and to extend those already established. A society of arts, manufactures, and commerce, on the plan of that established in London, was instituted at New York, and markets opened for the sale of home made goods; by which it soon appeared, says Mr. Coombe, "that neither the natives nor the manufacturers who had for some time past been invited from Britain, by very ample encouragements, had been idle. Linens, woollens, some of the coarser kinds of iron ware, malt spirits, paper hangings, &c., were produced to the society, and, when offered for sale, were greedily purchased. At the same time, lest the new woollen manufactories should be checked by a dearth of materials, most of the inhabitants came to a resolution not to eat any lamb, and not to deal with any butcher who should kill or expose lamb to sale."

Efforts of this kind were repeated at different times, from the commencement of the troubles to the breaking out of the war; but how far manufacturing industry was extended by them, we have not the means of ascertaining.

During the war of the revolution, some of the common arts and trades were stopped, for the want of materials: but it does not appear that the diminution of manufacturing industry was relatively greater than that of commercial or agricultural industry.

On the return of peace, the trades which had been suspended during the war, were resumed. Of the little capital then left to the Americans, a due portion was appropriated to the support of manufacturing industry.

From that time to the present, manufactures have been gradually extended; and have been subject to vicissitudes from the same general causes that have affected commerce and agriculture. From those fluctuations of prices, and that uncertainty of business which is produced by a super-extended system of paper credit, resting on an insufficient basis, this branch of industry has suffered more severely, perhaps, than any other. Its march has, notwithstanding, been onward, occasionally retarded, and occasionally accelerated, by political events.

Having, happily, had excise duties on only two occasions, and then limited to a few articles, it is impossible to give an exact account of the state of different manufactures, at different periods.

Hardie, in his chronological formulary, published in 1795, after mentioning the institution of the Pennsylvania Society for the Encouragement of Manufactures, in 1787, makes the following remarks, in a note.

"Every friend to America must rejoice at the rapid progress of its manufactures, and those gentlemen of affluence who employ their capital in promoting them, may be said, with propriety, to deserve well of their country. Amongst this number, there is none more conspicuous than John Nicholson, Esq., late comptroller general of the state of Pennsylvania, who is at present concerned, as principal, in the following manufactures, now either in operation, or contracted for and in preparation, in and near the city of Philadelphia: 1st, a factory for making the machinery and apparatus necessary for carding and spinning cotton; 2d, a ditto for wool; 3d, two mills for carrying on the carding and spinning of cotton, one of 2500 spindles, and the other of 500; 4th, a cotton stocking factory, to consist of forty looms; 5th, another ditto, of a less number, to be increased as it progresses; 6th, a factory of weavers, to consist of forty looms or more; 7th, a factory for making the machinery for carding and spinning wool; 8th, a manufactory for making the machinery for cotton printing and bleaching; 9th, a cotton printing and bleaching factory; 10th, a factory for making cloths without spinning or weaving; 11th, a hat manufactory, on an improved plan; 12th, a button manufactory; 13th, a manufactory for cleaning buttons; 14th, a manufactory for making planes and all such kind of edge tools; 15th, a glass manufactory; 16th, a manufactory for making oil cloths, floor cloths, &c.; 17th, a newly invented manufactory for weaving straps for carriages, hollow hose for fire engines, ships, &c.; 18th, a foundry for casting; 19th, a manufactory for constructing running improvements on mills; 20th, a manufactory to make steam engines applicable to mills, breweries, watering of cities, &c.; with various others, on a less scale."

The period which elapsed from the close of the war till the year 1796, was, in a peculiar sense, an age of speculation: and it was as natural for manufactories begun without sufficient capital, sufficient science, or sufficient skill, to miscarry, as it was for injudicious speculations in lands, in canal stocks, or in general commerce, not to succeed. Yet, at this period, many branches of manufacturing were carried on to a considerable extent. The common dress of the yeomanry was a domestic fabric, spun and wove by their wives and daughters, and dressed at the neigbouring fulling mill—a mode of manufacturing, it must be allowed, more favourable to the promotion of morals than to the increase of wealth. The various handicrafts were prosecuted with vigour by the inhabitants of the towns and cities. Mention is made of duck factories in successful operation in Massachusetts and Pennsylvania. American iron was an article of export. The spinning of cotton by the new machinery was begun in this period, which was further distinguished by successful experiments in steam navigation, and by the invention of Oliver Evans's improved mill machinery.

The spirit of speculation now found ample room for employment in the opportunities for commercial enterprise which were created by the wars which grew out of the French revolution. The demand for our agricultural products and for our shipping, caused less of labour and capital to be directed to certain branches of manufacturing than would naturally have followed that direction in a state of general peace. But the importance of manufactures was duly appreciated, and in every year some improvements were made in the useful arts.

The embargo and the other non-intercourse acts had a very stimulating effect on several branches of manufacturing. The foundations were laid, during this period, of some extensive establishments, which still continue in operation.

In 1810, the government made an effort to obtain information of the extent of manufactures. The marshals of the several states, and the secretaries of the territories, and their assistants, were directed, pursuant to instructions from the secretary of the treasury, to make returns of the manufacturing establishments and of the manufactures within their respective districts, territories, and divisions: which were transmitted to the secretary of the treasury, for the purpose of being laid before congress. Some elaborate and valuable returns were made, and transmitted; the greater number of them were irregular and very deficient: those which came from Massachusetts, Connecticut, New York, Pennsylvania, and Virginia were the most complete. It is certain, says Dr. Seybert, that the returns fall very short of the truth, as will be evident from the following instances, viz: *printing offices* were returned from only three states, and their number was stated to be one hundred and ten, when Mr. Thomas, the author of the history of printing, who was well informed on the subject, stated that the number of printing houses in the United States was more than 400. *Bookbinders*, *calico printers*, and *dyeing establishments* were returned for only one state; *glass works* for five states, omitting Massachusetts, in which very extensive establishments existed, from which glass of a superior quality had been, long before, exported to the other states; *bark mills* for only one state; *carriage makers* for three states; *blacksmith shops* for five, and *hatters* only for four states. We might very much extend this catalogue of omissions.

Notwithstanding the imperfectness of their inquiries, the agents reported 1776 carding machines, by which 7,417,216 lbs. of materials had been carded; 1682 fulling mills, and 5,452,960 yards, which had been fulled; 122,647 spindles; 325,392 looms; 153 iron furnaces, 53,908 tons of iron manufactured; 330 forges, which made 24,541 tons of bar iron; 346 trip hammers; 34 rolling and slitting mills, which required 6500 tons of iron; 410 naileries, in which 15,727,914 lbs. of nails had been made; 4316 tanneries, producing 2,608,240 lbs. of leather; 383 flaxseed oil mills, making 770.583 gallons of oil; 141,191 distilleries, producing 22,977,167 gallons of spirits from grain, and 2,827,625 gallons from molasses; 132 breweries, in which 182,690 barrels of beer had been made; 89 carriage makers, who made 2,413 carriages; 33 sugar refineries, in which

7,867,221 lbs. of refined sugar had been manufactured; 179 paper mills, furnishing 425,521 reams of paper; 4 stainers, who stained and stamped 148,000 pieces of paper; 22 glass works, which furnished 4,967,000 square feet of window glass; 194 potteries; 82 snuff mills; 208 gunpowder mills, in which 1,397,111 lbs. of powder had been made.

The following summary of the value of the manufactures of the United States is founded on the before mentioned returns, which were made by the marshals and other public agents in 1810: the value expressed is independent of the "doubtful articles."

1. Goods manufactured, by the loom, from cotton, wool, hemp, and silk, including stockings,	$39,497,057
2. Other goods spun from the materials above mentioned,	2,052,120
3. Instruments and machinery manufactured, estimated at $186,650; carding, fulling, and floor cloth stamping, by machinery, estimated at $5,957,816,	6,144,446
4. Hats of wool, fur, &c., and from mixtures thereof,	4,323,744
5. Manufactures of iron,	14,364,526
6. Manufactures of gold, silver, set work, mixed metals, &c.,	2,483,912
7. Manufactures of lead,	325,560
8. Soap, tallow candles, and wax, spermaceti and whale oil,	1,766,292
9. Manufactures of hides and skins,	17,935,477
10. Manufactures from seeds,	858,509
11. Manufactures from grain, fruit, and case liquors distilled and fermented,	16,528,207
12. Dry manufactures from grain, exclusive of flour and meal,	75,766
13. Manufactures of wood,	5,554,708
14. Manufactures of essences and oils from woods,	179,150
15. Refined sugars,	1,415,724
16. Manufactures of paper, pasteboard, cards, &c.,	1,939,285
17. Manufactures of marble, stone, and slate,	426,115
18. Manufactures of glass,	1,047,004
19. Earthen manufactures,	259,720
20. Tobacco manufactures,	1,260,378
21. Drugs, dyestuffs, paints, and dyeing,	500,382
22. Cables and cordage,	4,243,168
23. Manufactures of hair,	129,731
24. Various and miscellaneous manufactures,	4,347,611
	$127,694,602

Mr. Tench Coxe, of Philadelphia, to whom the secretary of the treasury, in 1810, confided the arrangement of the returns of the marshals, &c., concerning the manufactures of the United States, after offering these estimates, observed—"from a consideration of all the reputed details, and by a valuation of manufactures which are entirely omitted or imperfectly returned, for 1810," the foregoing amount of $127,694,602 is extended to $172,762,676: the sum last mentioned does not embrace the "doubtful articles." The doubtful articles include such manufactures as have a very near relation in their character to, and connexion with, agricultural pursuits, amongst which are the following, viz: cotton pressing, flour and meal, the mills for grinding grain, the barrels for containing the articles manufactured, malt, saw mills, horse mills, pot and pearl ashes, maple sugar, sugar from the cane, molasses, rosin, pitch, slates, bricks, tiles, saltpetre, indigo, red ochre, yellow ochre, hemp and hemp mills, fisheries, lime, grinding of plaster of Paris, &c., &c., all of which are estimated at $25,580,795 making the aggregate value of the manufactures of every description within the United States for 1810, $198,613,471.

The same able statistical writer says, in a work published in 1813, "The manufactures of the United States consume all our wool, which amounts to thirteen millions of pounds weight per annum. They also consume our flax, hemp, hides and skins, iron and lead, and much of our cotton. Besides our own productions of these things, we import much iron, hides, skins, flax, hemp, lead, and some wool. All of these are manufactured. There appears the best reason to affirm, that three-fourths part of all the manufactures consumed in the United States are made in our own families, shops, and manufactories. Ships and vessels, distilled spirits, beer, loaf sugar, cheese, starch, as well as hats, shoes, iron wares and piece goods, are meant to be included.

"The people of America have secured the benefits to themselves of manufactures in their own families, by their female weavers, by labour-saving machinery, and by labour-saving processes. The manufactures of red and white lead, for example, have suddenly absorbed all of that raw material which we can procure from our own mines and by the most industrious importation. The shot manufactory has been added in the same moment.

"Most of the operations of the American people, in their ordinary business, have been elicited by occasion. Hence it is, that the desire of a market at the farmer's door has led our women to the distaff and the loom, and has created the distillery, wherever there is produced a surplus of grain. Hence, also, it is that mill carders, spinners, fullers, weavers, hatters, shoemakers, smiths, carriage makers, and many other of those useful workmen are found in all our states, and in many of our counties and townships: and they often form a considerable portion of the inhabitants of the cities, towns, villages, and hamlets.

"The distance of the United States from the countries which would consume their productions, and furnish their supplies, with the consequent charges of exporting the first, and importing the last, are found to operate as a powerful encouragement to manufacturing in America. The duties on entry and export in Europe, and of entry here, add to the encouragement. This advantage, arising from the nature of things, can never fail, or even be diminished."

These remarks are extracted from a volume published nineteen years ago. Since that time, our population has nearly doubled itself, and our manufactures have advanced in, at least, an equal ratio.

We speak in general terms. *One* noble branch of manufacturing, that of ship building, has declined. From 1803 to 1812, the tonnage of newly built American vessels amounted annually to 102,811 tons. In 1828, the tonnage of newly built American vessels amounted to only 77,098. With the British, this art has, in the same interval, advanced greatly. The tonnage of newly built British vessels amounted, in the years 1810, 1811, and 1812, to 99,886 tons a year. The average of the three years, 1826, 1827, and 1828, was 185,947 tons. The decline of ship building in America, while it has advanced in Great Britain, is, by some, attributed in part to the high duties laid on iron, hemp, and some other articles. The duties on the materials used in the construction of a ship of 418 tons, are stated to be $2841, equal to $6.80 a ton.

Another noble art, that of making iron, has not advanced in equal proportion with the increase of wealth and population. We have already seen that as early as 1730, the Americans began to export iron to Europe. They continued their exportation of it till the period of the revolutionary war, and for some time after the conclusion of peace. Through a discovery made in England, of making iron with *coked coal*, the expense of the manufacture there has been greatly reduced. The neglect of our manufacturers of iron to profit by this improvement, is one of the most remarkable facts in the history of American arts. The quantity of iron now manufactured in the country is variously estimated at from 85,000 tons of pig iron, to more than double that amount.

The manufacture of leather is carried on extensively. Besides the hides produced in our country, we annually convert about two millions of dollars worth of foreign hides into leather.

Of wool, the Americans appear at all times to have manufactured all they raised. Three-fourths of the woollen cloths consumed in the country between the years 1791 and 1794, are believed to have been of domestic fabric. Mr. Pitkin estimated the number of sheep in the United States in 1816, at from 12 to 15,000,000. Mr. Niles, in 1826, estimated the number at 15,000,000. Taking two pounds and a half for the produce of each sheep, the total will be 37,500,000 lbs., to which if we add the wool imported, we shall have from 39 to 40,000.000 lbs. for domestic manufacture. Mr. Henry Lee, an intelligent merchant of Boston, and a member of the late Free Trade convention, estimates the annual value of the woollen manufacture of the United States at $59,000,000. Much of this is produced in the household way.

The spinning of cotton with the new machinery was begun in Rhode Island about the year 1793. No long time elapsed before similar works were established in Philadelphia. So great a curiosity was the operation in those days, that a formal visit was paid to the Globe Mills by some of the chief officers of government; and some of the cotton thread spun there was deposited in Peale's Museum, for the gratification of the virtuosi! With each succeeding year, the business of cotton spinning increased, and Mr. Pitkin estimated the amount of cotton consumed in the manufactories of the United States, in the year 1809–10, at 16,000,000 lbs. The present annual consumption is, agreeably to an estimate made by a committee of the New York tariff convention, 77,000,000 lbs. Mr. Lee, of Boston, had previously computed the amount at 70,000,000 lbs.

Another committee of the same convention has estimated the value of the paper annually manufactured in the country at seven millions of dollars, and that of the glass at three millions.

Some experienced publishers have estimated the annual sale of books at $10,000,000, and of newspapers at $3,000,000.

The governor of Connecticut states, in his last message to the legislature, that the quantity of raw silk produced in that state last year, would, if the art of manufacturing it had been properly understood, have produced seventy-five thousand yards of silk cloth. Experienced workmen have recently arrived in the country, through whom, it may be hoped, the science and skill requisite for the profitable management of the silk manufacture will be imparted to those engaged in that business.

To enumerate all the manufactures of the United States, would be to give a list of nine-tenths of the fabrics exhibited in the stores of a large city. Manufactures, using the word in its proper and comprehensive sense, are to be found in every town, in every village, and in almost every township. In some of the towns of the New England states, they form nearly the exclusive business of the inhabitants. In the west, they are carried on extensively. Pittsburgh bids fair to become the Birmingham of America. From their scattered state, it is difficult to form an estimate of the value of manufactured articles annually produced; but it must amount to some hundred millions.

Mr. Niles, about the year 1828, computed it to be three hundred millions of dollars; but this was probably below the real amount.

There is one branch of industry carried on very extensively in the United States, which we know not where to rank, unless it be under the head of manufactures: we allude to house-building. Of the importance of this branch of industry, some conception may be formed by considering the fact, that when a direct tax was levied in 1798, the lands were assessed at four hundred and seventy-nine millions, and the houses at one hundred and forty millions, or that the houses constituted nearly one-fourth part of the value of the real estate. What a great accession has since been made to this item of wealth! How much is annually added! In a single year, the new buildings erected in one of our large cities may exceed a million of dollars in value. What, then, must be the value of those built in every part of the Union? The number of houses building in England, when the census was taken in 1821, was 18,289. Such is the plentifulness of building materials, and so rapid is the increase of population, that more than twice this number must be annually built in the United States.

The annual consumption of foreign manufactures in the United States, is only from two to three dollars a head: and does not appear, in any series of years, to have exceeded four or five dollars. A nation with which the necessaries and comforts of life are as abundant as they are with the Americans, and which yet procures from abroad so small an amount of manufactures in proportion to population, cannot be considered as very backward in this branch of industry. Manufactures are, indeed, of less *relative* importance to us than to some nations of Europe: but which of those nations can be mentioned, which would not be willing to exchange part of its facilities for manufacturing, for such facilities for agricultural production as we possess?

To suppose the Americans to make all the manufactures they need, is to suppose our trade with several countries of Europe to cease: for those countries have little to supply us with but manufactures. This involves another supposition, that of finding a new employment for the labour and capital employed in raising agricultural products for exportation: and, consequently, a diminution of agricultural employment equal to the increase of some other branch of industry. It is probable that the time is remote, in which the raw produce of America will cease to be exchanged for the manufactures of Europe: but the existence of this trade will not prevent the increase of other branches of industry, since, from the very nature of things, the greater part of the articles the Americans use must be made by themselves. The rail roads and canals, recently made, and now making, will, by reducing the cost of transportation, greatly facilitate manufacturing production, and, together with steam navigation, give us many of the advantages which in former times were supposed to be within the reach of only a very dense population. Distance being, in a manner, annihilated by these improved modes of communication, we shall, in a few years, be able to carry the division of labour to an extent which will greatly improve the quality and increase the quantity of our manufactures.

By another cause will manufacturing industry be advanced. The improvements daily making in scientific and practical agriculture, will make a less amount of labour necessary for raising that quantity of agricultural products which is required for home-consumption and for exportation. The labour thus set free will naturally take the direction of manufactures: and its amount will be increased, by the labour set free, by the use of canals and rail-ways in transporting agricultural produce to market.

The early period at which manufactures were established in America, the extent to which they were carried before the revolutionary war, and their advance since that time, are so many assurances (if the protection orderly government gives to persons and property were not in itself sufficient assurance) that this branch of industry must flourish in America. Its *positive* advancement will be great; and its *relative* advancement will probably be greater than that of either commerce or agriculture. The nature and extent of our natural resources are such, that it is difficult, if not impossible, even to imagine a system of policy under which the wealth and population of the country would not increase. From the impossibility of finding profitable employment for all this labour and capital in commerce and agriculture, a great proportion of the annual increase will necessarily take the direction of manufactures.

It is true, indeed, that several hundred years of costly experiments have been required to bring the manufactures of Europe to their present state of perfection. But religious persecutions and political troubles may give a country exempt from such evils, all the advantages arising from a century of experiments, without that country's paying any part of the cost. In this way, the countries which embraced Protestantism at the period of the Reformation, got, in addition to their own useful arts, many other useful arts which till then were confined to their rival nations. The rise of some of the most important manufactures of Holland, is attributed to Flemings who fled thither from religious and political tyranny. The Huguenots of France, whom the revocation of the edict of Nantz obliged to forsake their native land, introduced many new branches of manufacture into England, Holland, and Germany. The time for religious persecution has gone by: but political troubles will long continue in Europe. The many advantages, natural and political, which the United States hold out to the emigrant, must make it the favourite refuge of those who fly from war and revolution, and those men will bring with them the arts in which their own countries excel. We shall thus have the arts in perfection, without paying the expense of centuries of experiments.

Within a half century, England has, through newly invented machinery and various scientific appliances, taken the lead of the nations in manufactures. But her patent right to the new machinery is near expiring. We ourselves have already adopted it to a considerable extent, and have, in some respects, improved it. Secrets in the arts cannot, in this age of the world, be long preserved. Science reveals them to every nation that is in a condition to profit by them. England must be content that other nations shall share the benefits of her discoveries. If any think that we are, in any useful or ornamental art adapted to our present state, in a disreputable degree behind the mother country, they may, perhaps, derive consolation from the reflection that dyeing was so much a mystery to the English previous to the year 1608, that they used to send their cloths white to Holland, which were there dyed, and afterwards returned to England for sale: that though their island abounds in copper ore, they derived their principal supply of copper, both wrought and unwrought, from Germany, till the year 1700, and continued to import copper tea-kettles and other vessels from that country, till the year 1750: and that, though their mines have furnished supplies of tin from the earliest ages of our era, they did not acquire the art of making tin plates till the year 1730.

FINANCES.

"The English colonists," says Adam Smith, "have never yet contributed any thing towards the defence of the mother country, or towards the support of its civil government. They themselves, on the contrary, have hitherto been defended almost entirely at the expense of the mother country. The expense of their own civil government has always been very moderate. It has generally been confined to what was necessary for paying the competent salaries to the governor, to the judges, and to some other officers of police, and for maintaining a few of the most useful public works. The expense of the civil establishment of Massachusetts Bay, before the commencement of the present disturbances, used to be but about £18,000 a year. That of New Hampshire and Rhode Island £3500 each. That of Connecticut £4000. That of New York and Pennsylvania £4500 each. That of New Jersey £1200. That of Virginia and South Carolina £8000 each. The civil establishments of Nova Scotia and Georgia are partly supported by an annual grant of parliament. But Nova Scotia pays, besides, about £7000 a year towards the public expenses of the colony: and Georgia about £2500 a year. All the different civil establishments in North America, in short, exclusive of those of Maryland and North Carolina, of which no exact account has been got, did not, before the commencement of the present disturbances, cost the inhabitants above £64,700 a year; an ever memorable example at how small an expense three millions of people may not only be governed, but well governed."

It is, indeed, an ever memorable example at how small an expense three millions of people may be governed, for the total is less than is now annually levied in Philadelphia for merely municipal purposes.

Lord Sheffield says, "The customs from the 5th of January 1768, when the Board was established, to 1775, when the troubles began, amounted to about £290,000, in a little more than seven years: out of which the expense of collecting is to be deducted. The only other revenue was the ground rents, which were never tolerably paid, and hardly defrayed the expense of collecting. Before the war of 1755, the expense of our establishment was £70,000. From the peace of 1763 to the time of the stamp act, it was £370,000."

If to the amount the Americans paid for the support of the civil establishment of the different colonies, be added the amount they paid for duties on goods imported, the total will not in any year exceed 500,000 dollars.

Sir William Keith, in his history of Virginia, gives the following account of the revenue of that colony, as it stood in 1738, and as it was established by acts of assembly, viz.

"First, The annual receipts of quit-rents, at two shillings sterling per one hundred acres, being the revenue of the crown, paid into the receipt of the king's private exchequer, is an increasing fund, amounting at present to about -	£3,500
"Secondly, The two shillings sterling per hogshead on tobacco exported, at a medium of thirty-two thousand hogsheads per annum, is - - - - - -	3,200
"Out of which, also increasing tax, is paid the governor's salary of two thousand pounds per annum.	
"Thirdly, One shilling per ton on two thousand tons of shipping yearly, is - -	500
"Fourthly, The established fees for marriage licenses, probates of wills, and entering and clearing of ships: together with other legal perquisites belonging to the governor residing there, is, per annum, - - - - - - -	600
	£7,800

Massachusetts imposed a tax of eight-pence a hogshead on molasses imported into her territories in ships belonging to other colonies: and South Carolina a tax of five pence a gallon on the same commodity when imported from the northern colonies. But the principal revenue of the colonies was derived from direct taxes on property: and herein is to be found the cause of the economy of the American governments previous to the Revolution. When revenue is raised by direct taxation, every man knows what he pays, and even the most stupid need not be told that he has an interest in keeping down the expenses of government. It is by various ingenious modes of indirect taxation, through which the exact amount any one pays is concealed both from himself and others, that governments are able to raise and to expend annually their tens and even their hundreds of millions.

But, besides this just and equitable way of raising a revenue, the colonial governments had another, the most pernicious that could possibly be devised. It was in issuing paper money, which in some cases was made a legal tender, and in others had an artificial value imparted to it by political regulations of a different character.

This expedient was first resorted to by Massachusetts. In the year 1690, when her troops returned from an unsuccessful attack on Quebec, they were on the point of mutinying for their wages. An act was passed for levying the sum, but the men would not stay till it could be brought into the treasury. The debt was therefore paid by paper notes of from ten shillings 'to ten pounds' denomination, which the soldiers could not pass except at a discount of thirty or forty per cent. But, by certain political contrivances the notes were, after a time, raised to par value; and the public authorities, encouraged by the restoration of the credit of their bills, afterwards issued others for defraying the ordinary expenses of government.

"This was," says Governor Hutchinson, "an easy way of paying public charges, which, no doubt, they wondered that in so many ages the wisdom of other governments had never discovered."

The example set by Massachusetts was quickly imitated by the other colonies. Pennsylvania contrived to keep her paper nearly on a level with silver in value: but the notes of the other colonies depreciated greatly, and in 1747 Massachusetts paid the greater part of her public debts with the *one tenth* part of the money for which her paper bills had been granted.

It was quite natural that this easy way of supplying the colonial governments with such funds as they wanted, should afterwards be resorted to as a means of making money plenty in every man's pocket. Whenever a cry arose of scarcity of money, all the governments had to do, was to issue more paper.

Our limits will not permit us to describe the pernicious effects this system had on the morals of the community, and, through their morals, on their industry and wealth. It opened to many individuals another way of growing rich, besides the old fashioned way of hard work and close economy. It substituted speculation for industry: and produced infinitely more evil in the colonies than was occasioned by any of the restrictions imposed by the British government on their commerce and manufactures. It was nevertheless persisted in, because the speculating part of society, who are always the most active, and generally the most powerful, found their interest promoted by it.

During the revolutionary war, this mode of raising a revenue was resorted to, because it was the easiest. The advances made at the Treasury of the United States in continental money, in old and new emissions, are estimated as follows:—

	Old Emission.	New Emission.
In 1776,	$20,064,666 66	
1777,	26,426,333 01	
1778,	66,965,269 34	
1779,	149,703,856 77	
1780,	82,908,320 47	891,236 80
1781,	11,408,095 00	1,179,249 00
	$357,476,541 45	$2,070,485 80

Till the issues of paper exceeded $9,000,000, there was not, according to the concurrent testimony of Mr. Jefferson and Mr. Paine, any sensible depreciation. But, in January 1777, one year and five months after the first emission, the depreciation was, as is stated by Pelatiah Webster, about twenty-five per cent, one dollar and a quarter of continental money being equal to one dollar of hard money. In March of that year, the exchange of continental for hard money, was as 2 to 1. In July 3 to 1. In December 4 to 1. In the year 1778, it fluctuated from 4 to 1 to 6 for 1. In January 1779, it rose to 7, 8, and 9 to 1. By April it became 22, by December 45. At the close of the year 1780, it was 100 to 1. In the latter end of February 1781, it rose to 120; in March, to 135; in April, to 200. In May it rose from 200 to 500, and on the 31st of that month ceased to circulate as money: but was afterwards bought on speculation, at from 400 to 1, to 1000 to 1.

This continental money was, in its true character, simple evidences of debt due by the government: and may, as such, in the first stage of its operation, be compared to the *forced loans* which the potentates of Europe have at times extracted from their subjects. As a *forced currency*, it may be compared to the base coin which the same potentates have issued in other seasons of difficulty. It can be justified (if it can be justified at all) only on the plea of state necessity—a plea never to be admitted without close examination.

It is difficult to believe that a people, so devoted as the Americans of that day were to the cause of liberty, would have scrupled about paying the necessary expenses of the war. But they were taught by some of their leading men that taxation was quite unnecessary, and that paper money would supply every financial want. It is reported that when a proposition was made in congress, to establish a regular revenue system, one member exclaimed, "Do you think, gentlemen, that I will consent to load my constituents with taxes, when we can send to our printer, and get a wagon load of money, one quire of which will pay for the whole!"

The best, if not the only excuse, for the policy which was pursued, is, perhaps, to be found in the opinion then prevalent, that money was something which derived its value from the authority of government. In no other way can we apologise for the acts which imposed severe penalties on those who refused to exchange their merchandise for paper, and which in some instances even *outlawed* the supposed offender.

Our ancestors were lavish of their blood in defence of their rights. If it was from any wish to save their treasure, that they preferred defraying the expenses of the war through the means of paper money, rather than by regular taxation, they did not succeed in their object. As a mode of raising revenue, the paper money might be compared to a tax, the expenses of collecting which were ten times as great as the sums brought into the treasury. The benefit the government derived from it was in no way commensurate with the burdens it imposed on the people.

The tories having, from the beginning of the contest, little confidence in continental money, the principal loss fell on the friends of independence. "The generous patriotic spirits," says an eye witness, "suffered the injury: the avaricious and idle derived benefit from the confusion." "We have suffered more from this," says the same eye witness, "than from *every other* cause of calamity: it has killed *more* men, pervaded and corrupted the choicest interests of our country *more*, and done more injustice than even the arms and artifices of our enemies."

The first recommendation of congress to the states, to raise money by a tax, appears to have been made on the 14th of January 1777: but this was in so indefinite a manner, without any sums being mentioned, or quota specified, that it had little or no effect. On the 22d of November in the same year, congress recommended to the states to raise five million dollars in the course of the year 1778, and to pay the same in quarterly instalments. In this recommendation, the quota of each state was specified, and in consequence thereof, some small sums were raised and paid by some of the states within the year 1778: others made some remittances, long afterwards, when continental money was as 20 to 1: but great part of the sum was never paid at all.

At different times in 1779, calls were made on the states for 60 millions to be paid in that year: and 135 millions to be paid in 1780, and six millions annually for 18 years, to commence with 1780, as a fund for sinking loans, and emissions, and paying interest. The dependence was still on continental money, and the system of taxation was merely to support the credit of the paper, by reducing the quantity in circulation. None of these requisitions had the effect intended: nor was it till after continental money had ceased to circulate, that the states would, to any extent, draw directly on the real resources of the country. When it was found impossible to depend any longer on paper issues, "very strong exertions were made to obtain money from the states, by a tax levied on polls and estates in the old and usual way, and such conviction of the necessity of public supplies generally took place, that considerable sums were obtained in this way."

The loans which were negotiated in Europe, were of essential service. The following is an account of those negotiated in France, omitting fractions of dollars, and reckoning five livres eight sols to the dollar.

		Livres.	*Dollars.*
1778,	February 6, Cash received from sundry individuals up to this day, including a loan from the Farmers-General,	3,000,000	555,555
	Loan by the Court of France, for this year,	3,000,000	555,555
1779,	Loan for this year,	1,000,000	185,185
1780,	Loan,	4,000,000	740,740
1781,	Loan,	4,000,000	740,740
	Subsidy from the Court of France,	6,000,000	1,111,111
1782,	Loan,	6,000,000	1,111,111
1713,	Loan,	6,000,000	1,111,111
		33,000,000	6,111,108

Besides a loan to the amount of 1,851,851 dollars, negotiated in Holland in 1781: some other loans from Holland: and a small loan from Spain.

Some assistance was derived from the Bank of North America. This institution went into operation on the 7th of January 1782, on a capital of 250,000 dollars in specie, supplied by government, and 70,000 subscribed by individuals. The accounts of the government and the bank, from that time to the end of the war, stood as follows, agreeably to a statement made by Mr. Morris, in the Pennsylvania legislature, in 1785.

			CR.	DR.	
April	2,	1782,	252,918	300,000	47,082
July	"	1782,	252,918	400,000	147,082
Oct.	"	1782,	253,394	400,000	146,606
Jan.	"	1783,	53,394	100,000	46,606
April	"	1783,	53,394	100,000	46,606
Oct.	"	1783,		164,781	164,781

Jan. 1, 1784, the debt was discharged.

The third column shows the amount advanced by the bank, beyond what was paid in by the government. For part of what was advanced, the state of Pennsylvania appears to have been security.

It is not possible to ascertain with certainty the expenses of the revolutionary war. The following is an abstract of an estimate made in 1790, by the Register of the Treasury, and furnished to a committee of congress.

The estimated amount of the expenditures of 1775 and 1776, is, in specie,	$20,064,666 66
1777 - - - -	24,986,646 85
1778 - - - -	24,287,438 26
1779 - - - -	10,794,620 65
1780 - - - -	3,000,000 00
1781 - - - -	1,942,465 30
1782 - - - -	3,632,745 85
1783 - - - -	3,226,583 45
To Nov. 1, 1784 - - - -	548,525 63
Forming a total amount of	$92,485,693 15

In this estimate the issues of paper for each year are valued at the average rate of the exchange for hard money in that year.

It is exclusive of certain debts of the United States, which were incurred at various periods for the support of the war, and which, the Register of the Treasury said, should be taken into a general view of the expense thereof, viz.

Army debt, upon commissioners' certificates, - - - -	$11,080,576 01
For supplies furnished by the citizens of the several states, and for which certificates were issued by the commissioners. - - - -	3,723,625 20
For supplies furnished in the quarter-master, commissary, hospital, clothing, and marine departments, exclusive of the foraging,	1,159,170 05
For supplies, on accounts settled at the treasury, and for which certificates were issued by the register, - - - - -	744,638 49
The foreign expenditures, civil, military, naval, and contingencies, amount, by computation, to the sum of - - - - -	5,000,000 00
The expenditures of the several states, from the commencement of the war to the establishment of peace, cannot be stated with any degree of certainty. But the United States have granted certain sums for the relief of the several states, to be funded by the general government, therefore, estimate the amount of said assumption,	21,000,000 00
Estimated expense of the war, specie,	$135,193,703 00

In April 1783, the debt of the United States (exclusive of the state debts) was estimated at $42,000,375, and the annual interest at $2,415,916. As the war had been brought to a close, it became necessary for congress to provide permanent funds for paying the interest. It had been foreseen by many, as Mr. Pitkin remarks, that this could not be done, unless congress had the power to regulate the commerce of the country, or at least, were vested with a power to levy duties on imports. By the articles of confederation, this power was not delegated to them, but remained in the respective states, which had the right of laying and collecting such duties on imports as they judged proper for their own benefit. Congress could only recommend to the states the propriety and necessity of delegating to them this power for the benefit of all. Accordingly, as early as the 3d day of July 1781, they had passed a resolution, recommending it to the several states, "as indispensably necessary, that they vest a power in congress, to levy, for the use of the United States, a duty of *five per cent* ad valorem, upon all goods, wares, and merchandize of foreign growth and manufacture, which may be imported into any of the said states, from any foreign port, island, or plantation, after the first of May 1781," with the exception of certain articles. They also resolved, at the same time, "that the moneys arising from the said duties, be appropriated to the discharge of the principal and interest of the debts already contracted, or which may be contracted, on the faith of the United States, for supporting the war, and that the said duties be continued until the said debts be fully and finally discharged." The journals of the old congress show, that this resolution, in the opinion of some members of that body, was not sufficiently extensive. A substitute was, therefore, proposed, couched in more general terms, declaring it to be "indispensably necessary, that the United States in congress assembled, should be vested with a right of superintending the commercial regulations of every state, that none may take place, which may be *partial* or contrary to the common interest; and that they should be vested with the *exclusive* right of levying duties upon all imported articles." This substitute was negatived, and the resolution which passed, was not accepted by the states.

On the 18th of April 1783, congress again urged the several states to establish some permanent funds for the payment of the debts of the United States. For this purpose, by a resolution of that date, they recommended to the states, "as indispensably necessary to the restoration of public credit, and to the punctual discharge of the public debts, to invest the United States in congress assembled, with a power to levy for the use of the United States, the following duties upon goods imported into the said states, from any foreign port, island, or plantation.

Upon all rum of Jamaica proof, per gall.	4-90ths of a dollar.	
other spirituous liquors	3	do
Madeira wines	12	do
other wines	6	do
common Bohea tea, per lb.	6	do
other teas	24	do
pepper	3	do
brown sugar	½	do
loaf sugar	2	do
other sugars	1	do
molasses, per gall.	1	do
cocoa and other coffee	1	do

and upon all other goods a duty of five per cent ad valorem, at time and place of importation: with a proviso that none of the said duties should be applied to any other purpose, than the discharge of the interest and principal of the debts contracted on the faith of the United States for the support of the war, agreeably to the resolution of the 16th of December last, nor be continued for a longer term than 25 years." It was calculated that the proposed duties would raise an annual sum of 915,956 dollars, which would fall short of paying the interest of the debt, about one million and a half of dollars. Congress, therefore, at the same time, recommended to the states "to establish for a time limited to 25 years, and to appropriate to the discharge of the interest and principal of the debt, substantial and effectual revenues of such nature as they may judge convenient, for supplying their respective portions of 1,500,000 dollars annually, exclusive of the aforementioned duties."

This system was not to take effect, until acceded to by all the states, but when adopted by all, was to be a mutual compact, irrevocable by one or more, without the concurrence of the whole, or a majority of the United States in congress assembled. To induce its adoption, an appeal was made to the states by congress, in an an able address, in which they urged the propriety and justice of making some provision, for the payment of the interest, at least, of a debt which was the price of their independence. From year to year this appeal was repeated: but, though it could not be denied, that in justice some provision should be made to satisfy the claims of the public creditors, these propositions were not agreed to by all the states in such a manner as to take effect. The opposition to them did not originate exclusively in a solicitude to preserve the prerogatives of the states. It was in part owing to what Judge Marshall calls "an unreasonable suspicion, which grew out of an opinion, that on commercial subjects, the interests of the different parts of the union conflicted with each other."

From the first of November 1784 to the first of January 1786, there was paid into the public treasury only 482,897 dollars 90 cents. Happily, a loan had been negotiated in Holland, after the termination of the war, out of which the interest of the foreign debt was partly paid.

In a report made to Congress by the Board of Treasury, dated September 20th, 1787, it is stated that the requisitions upon the states, for the payment of the interest of the domestic debt, in the years 1782, 1784, 5 and 6, amounted to the sum of $6,279,376 27, and the Board says, "It is with regret we are constrained to observe, that to the 31st of March last, the aggregate payments on account

of the requisitions, do not appear from any documents in the Treasury Office, to exceed the sum of	$1,003,725 57
Leaving a balance of no less than	5,275,650 60
	$6,279,376 27

It has been impressively remarked by Dr Seybert, "that it was the conviction that it was absolutely necessary that the power to regulate and control our intercourse with foreign nations, should be confided to congress alone, which *principally* induced the people of the United States to call the convention to revise the articles of confederation." But, strong as the desire was to enter into commercial treaties with foreign nations, to countervail the navigation laws of Great Britain, and the monopolizing edicts of other governments, and to substitute commercial regulations of a general nature for the partial and conflicting regulations of the different states, it is not likely that the present Federal Constitution would have been adopted, if the adequate revenue for satisfying the demands of the public creditors could have been raised under the old articles of confederation. To protect persons and property within its own limits, and to regulate intercourse between its own citizens, each state government found itself quite competent. The articles of confederation which had carried them successfully through one war, might be supposed sufficient to carry them through other wars, if others should occur. The evils which resulted from inadequate revenue and the want of a proper regulation of intercourse with foreign nations, concurred in inducing the call of the Federal Convention, and the adoption of the new constitution.

As constituting the vital spring without which the action of government could not long be continued, the subject of revenue was, says Judge Marshall, taken up in the house of representatives, in the first congress under the new constitution, as soon as it could be introduced. The qualification of the members was succeeded by a motion for the house to resolve itself into a committee of the whole on the state of the union: and in that committee a resolution was moved declaring the opinion that certain duties ought to be levied on goods, wares, and merchandise, imported into the United States: and on the tonnage of vessels. This resolution was introduced by Mr. Madison of Virginia in a short speech, in which he adverted to the numerous claims upon the justice of government, and to the impotency which prevented the late congress of the United States from carrying into effect what was considered the dictate of justice and policy.

As it was deemed important to complete a temporary system in time to embrace the spring importations, Mr. Madison presented the scheme of impost which had been recommended by the former congress, and had already received the approbation of a majority of the states; to which he added a general proposition from himself, for a duty on tonnage. By this scheme, specific duties were imposed on certain enumerated articles; and an ad valorem duty on those not enumerated. Mr Fitzsimmons, a member from Pennsylvania, offered an amendment to the original resolution, greatly enlarging the catalogue of enumerated articles. "Among those," he said, "which were contained in the list, he wished to subjoin to that in possession of the committee, were some calculated to encourage the productions of our country, and protect our infant manufactures, besides others tending to operate as sumptuary restrictions upon articles which are often termed those of luxury."

Mr Madison having consented to subjoin the amendment proposed by Mr Fitzsimmons to the original resolution, it was received by the committee; but in proceeding to fill up the blanks with the sum taxable on each article, it was soon perceived that gentlemen had viewed the subject in very different lights. The tax on many articles was believed to press more heavily on some than on others; it was supposed, also, to favour the products of particular states; and no inconsiderable degree of watchfulness was discovered, lest those which were more populous, and whose manufactures were in greater progress, should lay protecting duties whereby the industry of one part of the Union would be encouraged by premiums laid on the industry of another part.

After much discussion the bill was passed.

Towards the close of the session, a report on a petition which had been presented at an early period by the creditors of the public residing in Pennsylvania, was taken up in the House of Representatives. Many considerations rendered a postponement of this interesting subject necessary. But, two resolutions were passed, the one declaring "that the House considered an adequate provision for the support of the public credit as a matter of high importance to the national honour and prosperity;" and the other directing "the secretary of the treasury to prepare a plan for that purpose, and to report the same to the House at its next meeting."

On the 29th of September, congress adjourned to the first Monday in January 1790. Early in this second session, the secretary of the treasury made a report on public credit, with a plan for funding the domestic debt. He estimated the amount of the public debt as follows:

The *foreign debt* (due to France, Holland, and Spain)

Amount of the principal,	$10,070,307 00
Arrears of interest, to the 31st of Dec. 1789,	1,640,071 62
	11,710,378 62

The *domestic debt*, viz.

The principal of the liquidated part, bearing an interest of six per centum,	$27,383,917 74
The arrears of interest to the 31st of December 1790,	13,030,168 20
	40,414,085 94

The unliquidated part of the domestic debt, which consisted chiefly of the continental bills of credit,

was not ascertained, and was estimated at	2,000,000 00
The aggregate of the sums abovementioned, consisting of the foreign and domestic debts, constituted the debts of the United States, and together amounted to	$54,124,464 56

The amount of the debt of the individual states, which the secretary proposed should be assumed by the Union, was not ascertained: he estimated it at $25,000,000, principal and interest.

Amount of the debts of the United States as above,	$54,124,564 56
Of the debt proposed to be assumed on account of the several states,	25,000,000 00
Estimated amount of debt in 1790,	$79,124,464 56

After a long and animated discussion, a bill was passed, towards the close of the session, for funding the domestic debt of the United States, and assuming $21,500,000 of the debts due by the several states. The continental money was to be funded at the rate of one hundred dollars in the said bills for one dollar in specie. The certificates issued by the register of the treasury, the paymaster-general, &c. were to be funded at their nominal value.

For every hundred dollars subscribed, new certificates were ordered to be issued, purporting that the United States owed the holder thereof $66 66⅔ cents, bearing an interest of six per cent, payable quarterly; and certificates purporting that the United States owed the holder thereof $33 33⅓ cents, at six per cent interest, the payment of which interest should not commence till after the year 1800. For the arrears of interest, it was ordered that certificates should be issued bearing an interest of three per cent.

In this way were constituted what are known as the *old six per cent*, *deferred six per cent*, and *three per cent* stocks.

The assumed debt of the several states was funded by issuing six per cent certificates, for four-ninths of the amount; deferred six per cent certificates for two-ninths; and three per cent certificates for the remaining three-ninths.

To enable the government to pay the interest of the debt thus funded, an augmentation was made in 1790, of the duties on imported wines, spirits and coffee; and in the following session a duty was imposed on stills and domestic spirits.

As many who were then holders of soldiers' certificates and other evidences of debt, due by the old government, had purchased them at one-eighth or one-tenth of their nominal value, the terms offered by the new government must be regarded as having been very favourable. The public creditors were not slow in accepting the offer, and by the 31st of December 1794, there had been funded,

In six per cents,	$29,046,730 62
Deferred,	14,523,365 45
Three per cents,	19,484,840 68
	63,054,936 75
Of which there had been redeemed by purchase, with the surplus moneys in the treasury,	2,265,022 57
Leaving for domestic debt, unredeemed,	60,789,914 18
To this was to be added the foreign debt,	13,745,379 35
Unsubscribed debt,	1,561,175 14
Making the total debt,	76,096,468 67

by computation, exclusive of temporary loans, and of the amount due to the Bank of the United States, on account of subscription to the stock of that institution.

During the administration of Washington and John Adams, every possible effort was made to reduce the amount of the public debt. The duties on imports were either increased or arranged in a new form, by seven different acts, between the 10th of August 1790 and the 13th of March 1800. The duties on stills and domestic spirits were also increased, or arranged in a new form by three different acts. To these were added, at different times, duties on auctions, on retailers of wines and spirits, duties on stamps, on refined sugar, on snuff, and on carriages; and, finally, in 1798, a direct tax of two millions was imposed on real estate.

By an act of 1790, only $600,000 of the revenue derived from the permanent duties were reserved for defraying the proper expenses of government. All the rest was appropriated to the payment of the interest of the public debt, and for the redemption of the principal. In subsequent years it was found necessary to increase the appropriation for defraying the proper expenses of government; but, whenever this was done, additions were made to the duties on imported goods, or to the internal taxes, to keep the sinking fund unimpaired. Notwithstanding these efforts, the sinking fund did not become effective in reducing the amount of the public debt, till the year 1801; for, though between the first of January 1791, and the first of January 1800, old debts were paid to the amount of $8,164,232 84, new debts were, in the same period contracted, of the amount of $10,786,100.

The war with the Indians; the insurrection in western Pennsylvania, which it cost the government $1,250,000 to suppress; the transactions with Algiers, which cost $1,500,000; the still greater expenses incurred in the disputes with France, in 1798 and 1799, and the compensation of upwards of $2,600,000 which it was found necessary to allow to British creditors, for losses occasioned by legal impediments to the collection of debts, contracted prior to the peace of 1783, were so many extraordinary occasions of expense, which rendered an increase of the public debt in this period unavoidable.

During nearly the whole of this time, our financial affairs were more or less embarrassed. Money was, to the merchant, worth much more than the legal rate of interest; and as there was little loanable capital in the country, the difficulty the government found in borrowing was considerable. Of this we have a remarkable example in 1795, when, as stated by Mr Gallatin, "it borrowed eight hundred thousand dollars in six per cent stock, at par, and as cash, from the bank of the United States, which seems to have produced only seven hundred and twenty thousand dollars in specie." This was paying a premium of 11 per cent, besides six per cent interest. In 1796, it opened books for subscription to a loan of five millions, at six per cent, of which it obtained only eighty thousand. Advances made by the bank of the United States, in anticipation of the revenue, and intended to be temporary, remained unpaid for a much longer period than the bank contemplated, or the government desired; and at length the government was obliged to sell part of its bank stock, to satisfy the claims of the institution.

In this period, many changes were made in the form of the public debt. It consisted originally, as we have seen above, of certain amounts due to France, Holland and Spain; and of certain amounts due to domestic creditors, for which certificates were issued, of six per cent, deferred six per cent, and three per cent stocks. At the same time, when the act was passed for funding the domestic debt, the president was authorised to borrow twelve millions of dollars, solely for the purpose of discharging the arrears of interest, and the instalments of the principal of the foreign debt. Under this act, moneys were borrowed in Holland, by which the Spanish debt, amounting with interest to $259,083 05, was discharged in 1792 and 1793, and upwards of eight millions of dollars paid on account of the principal and interest of the French debt, in 1791 and the three subsequent years.

It being very inconvenient to the government to remit the sums required in Europe to pay the interest and instalments of the principal of the foreign debt, an attempt was made in 1795 to commute this debt for stock, the interest and principal of which should be payable in the United States. As an inducement to the foreign creditors to accede to this arrangement, they were offered a half per cent additional interest. The French alone accepted the offer; and, in consequence, certificates for $176,000, of four and a half per cent stock, and $1,848,900 of five and a half per cent stock were issued. The last portion of the French debt having been in this way commuted, Holland was from the year 1795 regarded as the only foreign creditor of the United States. The sum originally due to her having been increased by moneys borrowed to discharge the Spanish and great part of the French debt, the whole amount owing to Holland on the 1st of January 1796, was 11,939,000 dollars, bearing an interest of four and of four and a half per centum. Many years elapsed before this debt was completely extinguished.

In 1798, the president was authorised to receive into the public service such armed vessels as might be offered on credit by any persons, for which certificates of stock bearing an interest of six per cent should be issued. In this way the *Navy six per cents* were created. They amounted in 1799 to 711,700 dollars.

In the same year, the president was authorised to borrow five million of dollars, upon terms the most advantageous to the United States, to be applied to making up deficiencies in appropriations, and to defray the expenses of raising, equipping and calling into actual service, the militia, volunteers, and regular troops. Eight per centum was allowed for this loan, and the whole sum was obtained.

In 1800, three million five hundred thousand dollars were authorised to be borrowed on terms the most advantageous to the United States: but only one million four hundred and eighty-two thousand, could be obtained at eight per cent per annum.

We have already alluded to the abortive attempt made in 1796 to borrow five millions at 6 per cent, of which only 80,000 could be obtained.

The effect of these different transactions was such, that on the 1st of January 1801, the debt of the United States was as follows:

Foreign debt,	10,419,000 00
Domestic debt, viz. old six per cent and deferred stock,	37,947,458 20
Three per cent stock,	19,093,902 21
Five and a half per cent,	1,847,500 00
Four and a half,	176,000 00
Six per cent (of 1796),	80,000 00
Navy six per cent,	711,700,00
Eight per cent,	6,481,700 00
Temporary loans from U. S. Bank, and bank of NewYork,	3,440,000 00
Old unfunded debt,	2,840,790 39
	83,038,050 80
Deduct payments made by the treasury on account of subsequent years,	1,037,883 44
	82,000,167 36

On that day, the public debt was greater than on the first day of any other year, from the adoption of the constitution to the year 1814 inclusive, excepting in 1804, when the debt was increased by the purchase of Louisiana.

During the whole of this period, the revenue from the customs was gradually increasing, as may be seen by inspection of the table of receipts, at the end of this article. In 1792, the customs yielded $3,443,070. In 1800, upwards of $9,000,000. The revenue from internal taxes, which was $200,000 in 1792, amounted to $800,000 in 1800, besides upwards of $700,000 derived in that year from the new direct tax. Yet, owing to the succession of difficulties encountered by the government, the public debt, funded and unfunded, was greater by about six millions, than it was at the adoption of the constitution.

The whole amount paid into the treasury, from 1792 to 1802 inclusive, on account of the internal taxes laid previously to 1800, was 6,105,097 dollars. The greatest amount that *accrued* in any one year was in 1801, being 989,533 dollars 29 cents, and accruing from the following objects:

From spirits distilled within the United States,	$178,659 21
From stills,	257,070 03
From refined sugar,	76,539 65
From sales by auction,	66,122 84
From licenses to retailers,	69,173 74
From carriages,	73,926 21
From stamps,	268,041 46
	$989,041 61

The greatest amount *received* on account of these taxes, was in 1801, being $1,048,033. Small sums, on account of these taxes, continued to be received at the treasury for many years after the acts imposing them were repealed.

The duty on spirits was, at first, from 9 to 30 cents a gallon, according to the proof or strength; and 60 cents a gallon on the capacity of a still, used in a town. These duties were subjected to several modifications. The duty on retailers of wine and spirituous liquors was five dollars each. In 1794, the duty on a coach was ten dollars; on a chariot, eight dollars; on a phaeton or coachee, six dollars; on any other four-wheel, and on every two-wheel top carriage, two dollars; on every other two-wheel carriage, one dollar. By an act of 1796, the duties were increased about 50 per cent. The duty on refined sugar was two cents a pound. On sales by auction, from a quarter to a half per cent. The stamp duties were laid on bank notes, legal documents, bills of lading, &c. and were various in amount.

By the time Mr. Jefferson entered into office, most of the difficulties the new government had to encounter, had been surmounted. This rendered it practicable to make some desired changes in the system of finance, and on the 6th of April 1802, an act was passed repealing the internal taxes from the 30th of June of that year. On the 29th of the same month an act was passed appropriating 7,500,000 dollars to the Sinking Fund. From that time to the breaking out of the war with Great Britain, in June 1812, the Sinking Fund was efficient.

On the purchase of Louisiana, the United States agreed to pay 15,000,000 dollars; 3,750,000 dollars to be paid to our own merchants for their claims of a certain description on the French government, and the remainder, being 11,250,000, to be paid in stock at six per cent. To carry into effect this agreement, stock to that amount was issued, in pursuance of an act of congress passed November 10th 1803, and made payable to the assignees of the French government. By the same act the sum of 700,000 annually, was added to the Sinking Fund, to pay the interest on the stock.

This was the only new debt incurred during the administration of Jefferson.

In 1806, the secretary of the treasury said, "all the species of debt, on which the entire appropriation of 8,000,000 dollars could operate, would be reimbursed previous to 1809." To promote the rapid discharge of the remaining debt, he proposed, if it should meet the approbation of the public creditors, to convert the old six per cent, the deferred six per cent, and the three per cent stocks, of which, according to the provisions of the law of 1790, no more than eight per cent could be redeemed annually, into a common six per cent stock, redeemable at the pleasure of the United States. An act was passed in accordance with these views, in 1807: and some of the public creditors accepted the terms proposed. In consequence, certificates were issued for $6.294,051 of a new stock called *exchanged six per cents*, the same being in lieu of old six per cent and deferred stocks: and certificates to the amount of 1,859,850 dollars, were issued for another new stock called *converted six per cent;* one hundred dollars of this new six per cent stock, being given in exchange for 153 dollars 99 cents of the old three per cent stock.

Though a debt of $15,000,000 was incurred by the purchase of Louisiana, the sum total of the public debt was reduced during Mr. Jefferson's administration, from $82,000,000 to less than $57,000,000. This reduction was owing in part to the character of the times: but it would be injustice not to ascribe it in part to the character of the man, and to the principles of his administration.

In the first years of Mr. Madison's term of office, circumstances rendered it practicable to pursue the same policy: and on the first of January 1812, the public debt was as follows:

Six per cent and deferred stock,	$17,066,941 98
Three per cent,	16,157,890 04
Six per cent of 1796,	80,000 00
Louisiana six per cent,	11,250,000 00
Converted six per cent,	565,318 41
Old unfunded debt,	33,884 33
American claims assumed by Louisiana convention,	57,946 55
	$45,211,981 31
Deduct payments by the treasury on account of subsequent years,	176,857 61
	$45,035,123 70

The five and a half per cent stock, the four and a half per cent, the Navy six per cent, the eight per cent, and the exchange six per cent of 1807, had been completely reimbursed: and the other denominations of stock greatly reduced in amount. The payments made on account of the principal of the debt from April 1st 1801 to January 1st 1812, amounted, according to the treasury statements, to 46,022,810 dollars. The sums received from 1801 to 1811 inclusive, which were applicable to the payment of the interest and principal of the public debt, amounted to about 90,000,000 dollars. During the period in which the government paid this sum, no additional taxes of any importance were imposed, except a duty of two and a half per cent on goods imported, paying ad valorem duties, to defray the expenses of the war with Tripoli, and of intercourse with the other Barbary powers, and which was called "the Mediterranean Fund." This duty was to have ceased in three months after the termination of the war with Tripoli: but was continued by various acts of congress until 1815.

When the war of 1812 commenced, the annual interest on the public debt did not exceed two million dollars. The income of government in 1811, exceeded fourteen million dollars, and all its expenditures in that year, independent of what was paid on account of the public debt, and of the army and navy, did not amount to 1,800,000 dollars. Yet a war of only two years and eight months, produced very serious financial embarrassments, some of the consequences of which were felt by the nation for a long period.

In anticipation of the declaration of war, congress, by an act of March 14th, 1812, authorised the borrowing of 11,000,000 dollars, at an interest of six per cent. Under this act there was obtained in the course of the year 1812, the sum of $10,184,700. Of this sum $2,150,000 were obtained of certain banks on special contract, 1,350,000 being made repayable in 1813, 750,000 in 1814, and 50,000 in 1817. For the residue, being 8,034,700 dollars, six per cent stock was issued, redeemable after the 1st of January 1825. About one half of this last sum was obtained from banks, and the residue from individuals.

On the 8th of January 1813, a further sum of sixteen millions was authorised to be borrowed. This was obtained by contract, and principally from individuals, at the rate of eighty-eight dollars in the hundred, viz. for every eighty-eight dollars paid in money, a certificate of stock for one hundred dollars was to be issued; or what is the same, for every hundred dollars which the United States received, they were to issue a certificate of stock for $113 63 cents. The amount of stock issued for this loan of sixteen millions, was 18,109,377, making a bonus of 2,109,377 to the lenders.

By an act of August 2d, 1813, a further loan of seven millions and a half was authorised, and was obtained by issuing stock for 113 dollars 31 cents, for every hundred dollars received. Under this act, stock to the amount of 8,498,583 dollars, was issued, making a premium or bonus to the lenders of 998,583 dollars.

On the 29th of March 1814, authority was given to borrow 25,000,000 dollars; but the whole sum could not be obtained. On the 4th of April, the secretary of the treasury issued his invitations for a loan of ten millions, as part of the 25 millions: and on the 25th of July, further invitations for a loan of six millions. The whole sum obtained by virtue of this act, was only $12,551,511 87, for which, stock to the amount of $15,661,881 was issued. For nearly $12,300,000 of money received, stock was issued at the rate of $125 for $100 paid in, making a nominal bonus to the lenders of $3,110,306, in the aggregate. As much of this loan was paid into the treasury in bank notes, which were many per cent below par, and as the interest and principal have been paid in a more valuable medium, it is probable that the *real* bonus has not amounted to less than five millions.

On the 14th of November, in the same year, an act was passed to authorise the borrowing of $3,000,000, but the sums obtained were so small, that only $252,801, of new six per cent stock was issued in consequence.

For less than 44 millions paid into the treasury in the form of loans, during the war, and part of this in bank notes 20 per cent below par, it was necessary to issue upwards of 50 millions of stock.

As a further aid to carrying on the war, emissions were made of treasury notes, bearing an interest of five and two-fifths per centum, reimbursable one year after the day on which they were issued, and receivable in payment for duties, taxes, and public lands. In 1812, authority was given to issue notes of this description, to the amount of $5,000,000: in 1813, to the amount of $10,000,000; and in 1814, to the amount of $20,500,000, making in the aggregate, $35,500,000, of which $28,318,400, were actually issued, and passed at a great depreciation.

Immediately on the declaration of war, one hundred per cent was added to the duties on imports and tonnage, but the commerce of the country being restricted by belligerent operations, the revenue from the customs for the whole of 1812, (six months of which were months of peace) amounted to less than nine million dollars. In 1813, this revenue rose to upwards of thirteen millions: but in 1814, in consequence of the blockade of our coast, it sunk to less than six millions.

From a report of the committee of ways and means, it would appear as if congress depended on bank credits as a means of carrying on the war! However this may have been, it is certain that even the first steps towards raising a revenue by internal taxation, were not taken until July and August 1813: when acts were passed, to take effect from the first of January 1814, imposing a duty of from ten to twenty-four dollars each, on retailers of wine, spirits, and foreign merchandize: a duty on stills, of 108 cents per gallon per year: a duty of from one dollar to twenty dollars on carriages: a duty of 4 cents a pound on refined sugar; a duty of from one quarter of one per cent, to one per cent on sales by auction; and a stamp duty, varying from one cent to fifty dollars, according to the importance of the document for which the stamp might be used. The sums which *accrued* from these taxes in the year 1814, exceeded three millions of dollars: but the sums actually paid into the treasury, fell short of 1,700,000 dollars.

In the same year, a direct tax of 3 millions was laid; which, within the year, brought into the Treasury 2,219,447 dollars. But the whole revenue of government during the years 1812, 13, and 14, from customs, internal taxes, direct tax, the public lands, and every other source, except loans and Treasury notes, amounted to hardly 36 millions, or 12 millions for each year.

The policy of carrying on the war by means of loans, cannot be said to have been an unwise one: but what ought to have been an essential point in this policy, viz. the drawing on the real resources of the country to an extent sufficient to support the credit of government was neglected too long. Under any circumstances, it would have been necessary to pay a high premium on loans, for our countrymen had little to lend, much of their invested capital having been rendered unproductive by the events of the war, and much of their floating capital taking a direction towards manufactures: but the principles of the financial policy which were adopted, would, in the course of a few months, have rendered it impossible to borrow money on any terms. Fifty per cent was, indeed, added to the duty on retailers, in December 1814: a duty of 20 cents a gallon was imposed on distilled spirits: the duty on carriages was greatly increased: one per cent was added to the duty on auctions: and a direct tax of six millions was laid for 1815: but any person who candidly considers the events of the following years, will probably be convinced, that, without an increase of revenue from the customs, it would have been impossible for government to support its credit. Even so late as December 1814, it appeared to be the wish of some of the leading men in the administration, instead of depending on the real resources of the country, to depend on a bank they proposed to form, with a nominal capital of fifty millions, made up principally of public stock and treasury notes, all, then, much below par.

Peace was providentially restored in an early part of 1815. On the first of January of that year, the debt of government, funded and unfunded, stood, according to the Treasury books, at 99,824,410 dollars, and there were outstanding claims against it to the amount of 30 or 40 millions more. On the 20th of February the *ascertained* debt was 108 millions. As the means of satisfying, or rather of deferring satisfaction of some of these claims, an act was passed on the 24th of February 1814, under the authority of which, Treasury notes to the additional amount of 7,815,391 dollars, were issued. It was provided that such of the notes of this new emission, as were of a less denomination than one hundred dollars, should bear no interest: but might be funded at seven per cent and that such as were of the denomination of one hundred dollars and upwards, should bear an interest of five and two-fifths per cent and might be funded at a rate of six per cent interest.

As a means of absorbing part of the outstanding treasury notes, issued under the authority of the different acts of 1812, 13, and 14, invitations were given for a loan of $18,452,000, subscriptions to which might be made in any treasury notes issued previous to the third of March 1815, the day of the passage of this act. In this way, were created three new denominations of stock; but which still left at the end of the year, between seventeen and eighteen millions of treasury notes unfunded, and a debt of upwards of one million dollars, obtained as a temporary loan, unsatisfied.

In the acts passed during the war for raising a revenue by internal taxation, it was provided that the taxes should not be repealed till one year after the cessation of hostilities. But it was found necessary, as will be shown hereafter, to continue these taxes for nearly three years after the return of peace: and, in addition, it was deemed expedient on the 1st of April 1815, to pass an act imposing a duty of one dollar a ton, on pig, bar, slit, and rolled iron, manufactured in the country, one dollar and a half a ton on iron castings, one cent a pound on nails, five cents a pound on wax candles, three cents a pound on tallow candles, eight per cent ad valorem on hats, caps, and umbrellas, three per cent on paper, fifty per cent on playing and visiting cards, six per cent on saddles and bridles, beer, ale, and porter, twenty per cent on manufactures of tobacco, five per cent on boots and leather: two dollars a piece on gold watches, one dollar on silver watches, and a tax on household furniture, from one dollar to one hundred dollars, according to a graduated scale of valuation.

In consequence of this act, the amount received from internal taxes, during the year 1815, was increased to 4,600,000 dollars, and there being a small increase in the customs, the whole revenue of the government, for the year, independent of what was derived from loans and treasury notes, was a little less than 15,700,000 dollars. It being found impracticable, or deemed inexpedient, immediately to reduce the army and navy to the peace establishment, the charges on government were very heavy in this period, and the outstanding claims which were daily brought in, occasioned much embarrassment. At the end of the year, the ascertained debt, was upwards of 123 millions.

If hostile operations had been continued to this time, the confusion would have been inextricable: but the return of peace rendered it practicable to resort to all those expedients for changing the form of debt, and deferring the day of payment, which constitute so great a part of the modern art of financiering. The officers of the Treasury had free scope for exercising their abilities in this way, for the various acts we have mentioned authorising loans, and two others, one passed December 21st 1824, for a loan of six millions, and another on the 9th of January 1815, for another loan of equal amount, together with the acts respecting Treasury notes, gave them authority to borrow to almost any extent, and in almost every form, in which borrowing would seem possible.

With so much skill did they exert those powers of financial metamorphosis which the funding and Treasury note system gave them, that, though the *bona fide* revenue of government for the whole year, had been only 15,700,000 dollars, and though the charges of government for the same period amounted to upwards of 39 millions,—there was, according to the published statements, a balance in the Treasury, on the last day of the year, of upwards of thirteen million dollars!

This balance was, unfortunately, not such as could be immediately applied where it was most wanted. Five months before the conclusion of the war, all the banks south and west of New England, excepting the old bank at Nashville, had suspended specie payments. On the return of peace, the banks in the principal cities could have resumed payments in specie without making any great sacrifices, for they had in this interval added little to their issues. If the government had been free from embarrassment, it might, by refusing to receive the notes of any but specie-paying banks in discharge of duties, have induced the principal institutions to pursue the course which sound principles dictated. But the credit of government was even worse than that of the banks: and from policy or from necessity, it connived at the continued suspension of specie payments, a suspension which, it was originally understood, was not to be prolonged beyond the close of the war. Under these circumstances, the banks naturally began to increase their issues, and produced that *appearance* of prosperity which is one of the first effects of a plentiful emission of paper money. From the great variety of circulating medium, and the inequality of its value, some inconvenience was suffered, but no small number of men found this evil more than compensated by the rise in the price of real estate, and the briskness of nearly every description of business. If the merchant at Pittsburgh was forced to give ten per cent to have his western notes exchanged for paper current in Philadelphia, he knew how to compensate himself by putting on his goods an additional price, equivalent to the difference in the currencies. Labouring men, in many cases, sustained a real loss, from their employers paying them in notes of inferior value: but they vented all their indignation on the innocent exchange brokers. Men of business could calculate the par of exchange, and regulate their transactions accordingly. The time when they were to suffer, by the necessary reaction of the system, and the consequent fall in the price of real estate, and of nearly every other description of property, had not yet arrived.

The condition of the government was very different. It could not increase its charges for duties and taxes in each port and in each place, in proportion to the depreciation of the currency. The amount of each duty and each tax was determined by general laws, and was *nominally* the same throughout the country, whatever might be the difference in the currencies. The greater part of its receipts were in places where the currency was below par: and it was compelled to make many of its payments, in places where nothing was current but specie, or paper exchangeable for specie on demand. It profited in one way, as we shall show hereafter, by the abundance of circulating medium: but this profit would have been reduced to little or nothing, if it had paid the common premium of exchange. To use the language of a writer of that day, "The public treasury exhibited a phenomenon in finance. Many millions of surplus revenue, with as many different values as there were offices of collection, constantly accumulating at those ports of entry where it was least valuable, and applicable only where it was collected, while the great mass of the public debt and expenditures was at those places where least available; even the quarterly interest on the public debt, due where the currency was the most valuable, could not be discharged, but by the evidence of a new debt, in the form of seven per cent treasury notes—thus creating an invidious distinction as well between the debtors as the creditors of the public, in many cases exceeding 20 per cent on the amount of their debts and claims respectively."

This writer, in speaking of "millions of surplus revenue," has special reference to the year 1816. It was in that year or the second year after the war, that the increased issues of paper were most efficient in bringing both the government and the people into a state of *apparently* very great prosperity. The *prices* of nearly every kind of property being raised many per cent, most men supposed their riches to be increased in proportion. The importation and consumption of foreign commodities, were in a ratio to the supposed increase of the ability of people to pay for them: and the revenue from the customs alone, amounted in this year, to the enormous sum of *thirty-six millions*, being nearly five times as much as had been derived from the same source in 1815. The internal taxes, in the same year, produced upwards of five millions, the direct tax more than four millions, and the public lands more than 1,700,000, making the whole revenue for the year 1816, upwards of *forty-seven millions*. The revenue of this one year, exceeded the total amount of the national debt on the first of January 1812.

At the end of the year, the balance in the treasury was upwards of twenty-two millions: but such was the nature of the money of which it was composed, that the Secretary of the treasury found it necessary to borrow 500,000 dollars from the bank of the United States, in anticipation of the commencement of regular operations by that institution, to pay the quarterly interest on the public debt, due at Boston on the first of January 1817.

The public debt was, on that day, according to the Treasury statement, greater than on the first of January 1816: but this was owing to seven millions of five per cent stock having been issued as subscription to the bank of the United States: and owing to upwards of five millions of stock, issued to satisfy certain claimants to land in Mississippi, being then first introduced into the schedule. This stock, which was issued under authority of an act of 1814, bore no interest, and the principal was made reimbursable out of the proceeds of the sales of public lands in Mississippi. The old debt had, during the year, been reduced upwards of eleven millions, but, through the subscription to the bank of the United States, and the including of the Mississippi stock in the general statement, the total appeared to be increased.

The public debt on the first of January 1817, when it was greatest according to the published statements, consisted of the following items:—

Six per cent and deferred stock,	$6,532,355 08
Three per cent stock,	16,158,180 79
Six per cent (of 1796),	80,000 00
Louisiana, six per cent,	10,923,500 00
Exchanged six per cent,	2,984,746 72
Six per cent stock of 1812,	7,810,500 99

Six per cent stock of 1813, -	26,607,959 38
Do. - of 1814, -	15,954,619 85
Six per cent treasury note stock,	60,834 02
Six per cent stock of 1815, -	12,288,149 64
Seven per cent stock, - -	8,856,960 00
Five per cent stock, subscription to the United States bank, -	7,000,000 00
Old unfunded debt, - -	31,191 13
Temporary loans, - - -	550,000 00
American claim assumed by Louisiana convention, - - - -	41,624 63
Treasury notes, - - -	3,450,000 00
Mississippi stock, - - -	4,16 ,343 12
Total, - - -	$123,491,965.16

Against this was the balance of twenty-two millions in the treasury, consisting principally in the notes of non-specie paying banks, which notes the officers of finance were to use their best skill to have exchanged for certain portions of the public stocks.

The withdrawal of a portion of the bank paper from circulation, in the latter part of 1816 and the beginning of 1817, as a means preparatory to the resumption of specie payments, had a tendency to lower prices, and thus make the importations less than they were in the previous year. But the withdrawal was not made to any extent except by the banks on the seaboard, and the total reduction in the amount of circulating medium, was not sufficient to change either the character or the course of trade, or to convince the majority of men of the fallacy of the principles on which they estimated their riches. The importations, though less extensive than they had been in the previous year, were very great, and the customs yielded a revenue of twenty-six millions in 1817,—a greater amount than they have yielded in any year, either before or since, always excepting the ever memorable year of 1816. In the same period, the internal taxes produced upwards of $2,600,000, the direct tax upwards of 1,800,000, and the public lands nearly two millions. The whole revenue exceeded 33 millions, which, added to the balance in the treasury on the last day of 1816, placed nearly fifty-six millions at the disposal of the officers of finance, for the service of the year 1817.

This amount could be more efficiently applied than the sums received in 1815 and 1816. By a resolution of congress, it had been provided that only specie and the notes of specie paying banks, should be received in payment of duties, after the 20th of February 1817. From that day, the serious embarrassments of the government were at an end. All the evils in subsequent years, which were the necessary, though remote effects, of the attempt made to carry on the war of 1812—14, by means of bank credits, and bank notes, fell either on the banks or on the people.

The expenditures for naval and military purposes, which exceeded 23 millions in 1815, and amounted to 20 millions in 1816, were, in 1817, reduced to eleven millions. Through the reduction in this part of the public expenditures, and through the operation of the other causes we have alluded to, it became practicable to redeem twenty millions of the public debt, and the total amount was thus, at the end of the year, reduced to 103 millions.

The last of the internal duties which had been imposed for war purposes, ceased with the termination of this year. The act imposing duties on sundry American manufactures, had been repealed on the 26th of February 1816. The act laying a duty on household furniture, and gold and silver watches had been repealed on the 9th of April 1816. The taxes on stills, domestic spirits, carriages, refined sugar, sales by auction, and the stamp duties were continued to the end of 1817. The duty on retailers, which had been increased fifty per cent by an act of December 23d, 1814, was by an act of December 31st, 1816, reduced to its old amount. It ceased altogether, with the remaining war taxes, on the 31st of December 1817.

The direct tax imposed for 1814, was three millions: that for 1815, five millions: for 1816, three millions.

The sums received on account of the internal taxes, in the years 1814, 15, 16, and 17, amounted to 14,143,852 dollars: on account of the direct taxes, in the same years, 10,469,992 dollars. On account of the internal taxes in the three succeeding years, 1818, 19, and 20, the receipts were 1,291,133 dollars: on account of the direct taxes in the same years, 397,570 dollars. On account of the internal taxes, in the nine years from 1820 to 1829, both inclusive, 304,702 dollars: on account of the direct taxes, in the same period, 91,996 dollars: making an aggregate of 15,739,688 dollars, received on account of the internal taxes; and of 10,941,550, received on account of the direct taxes. A small part of the war taxes is yet to be collected.

By an act of the 3d of March 1817, so much of any acts as authorised the issuing or re-issuing of treasury notes, was repealed: all the treasury notes which had become, or should become, the property of the United States, were directed to be cancelled or destroyed, at such times, and under such regulations and securities as the commissioners of the sinking fund should establish. At the same time, all such acts as authorised any further loan were repealed, and the appropriation in favour of the sinking fund was increased from $8,000,000 to $10,000,000. To dwell on the modifications which this act made in the sinking fund, is unnecessary. It has not been by opening a separate account under the head of "Commissioners of the sinking fund" and entering thereunder certain debits and credits, that our national debt has been reduced to its present small amount. It has been by keeping the expenditures for a series of years below the receipts, aided in no small degree, at the commencement, by that system of measures, through which the after consequences of the financial policy of 1812—14 were thrown off the government, and thrown on the incorporated institutions and the people. "Strictly speaking," says Dr. Seybert, "the essential character of a sinking fund, was not to be found in the operations of that of the United States: all its sources might vary and fail: even the application of the fund was varied with circumstances. The annual reports of the commissioners exhibit the sinking fund in the payment of the interest and charges, and the redemption of the principal of the public debt; in the reimbursement of temporary loans, and the absorption of treasury notes; in the payment of commissions and charges to agents in the United States, and in Europe; in the payment of arrearages due to the army, and in discharging the floating debt. Instead of being uniformly confined on a single line of operation, it was active in all situations as temporary circumstances indicated."

If, since the time of Dr Seybert, what is called the Sinking Fund, has been more faithfully applied to the purposes expressed by law, it has been because there has been less necessity for diverting it from its original object.

The balance in the treasury at the commencement of the year 1818, was a little less than 15,000,000 dollars. The receipts from customs during the year were 17,000,000; from the internal and direct taxes, being part of the arrears of the same, upwards of 1,200,000; from the public lands, 2,600,000; from the Bank of the United States upwards of 500,000. The whole revenue fell a little short of 21,600,000, which, with the balance in the treasury, made a sum of nearly 36,000,000 for the service of the year.

During this year a reaction commenced, the serious consequences of which were long felt by many of the people. We can but briefly describe causes and effects which it would require a volume fully to unfold.

The provisions of the charter of the United States Bank were, that its capital should be $35,000,000, of which 7,000,000 should be subscribed by the government and paid in five per cent stock. Of the remaining 28,000,000, which were to be subscribed by individuals, three-fourths were made payable in government securities.

The act was passed in April 1816, when the government securities were at a discount in the market. By creating a new use for these evidences of the public debt, it gave them a new value, and about the time the bank of the United States went into operation, the public stocks rose to par.

The next grand operation of the treasury department, was to exchange part of the balance of 22,000,000 of the "unconvertible" notes of the state banks, for evidences of the public debt. In six months after the bank opened its doors, says a writer whom we have already quoted, "the secretary of the treasury, by the magic of the fabled finger of Midas, transformed the paper deposits of the treasury into gold and silver, and redeemed from the bank 13,000,000 dollars of the funded debt, part of its capital."

The object of government in instituting the bank, was to relieve the treasury: but it hardly needs be mentioned that the object of private men in accepting charters is their own pecuniary benefit. If no means could have been found of investing what had been given by the government in exchange for the public stocks, the net revenue of the bank would have been diminished 780,000 dollars per annum. It was natural for the directors to try to devise means to prevent the curtailment of profits, and the easy means of increasing the amount of loans to individuals as naturally suggested itself.

By the 26th of February 1818, the amount of bills discounted by the bank exceeded $42,000,000. In July of the previous year, it appears to have been less than 4,000,000. So great and so sudden an increase, was more than the commerce of the country could bear. In fact, though the business of the local banks had been considerably reduced by July 1817, there were still so many evidences of debt, of every kind, public and private, in circulation, that nothing but a voluntary surrender on the part of the directors and stockholders of one half or of three fourths of their expected profits, could have restored business to the state in which it was before the war began. It was not to make sacrifices of their own property in order to relieve the treasury department that they had subscribed to the bank established by congress: but to make profit for themselves; and they acted as is natural for men to act who adventure in banking operations.

For some time the policy of increasing the amount of loans to individuals, was such as to give every encouragement to proceed in it. In September 1817, the shares of the bank were sold at 56 per cent advance: and the apparent prosperity of the country was as great, or nearly as great, as in the remarkable year 1816. In February 1818, bank shares were at 46 per cent advance, being 10 per cent lower than in the preceding September, and other indications of a reaction were observable. By the 20th of July, the pressure on the bank was such, that the directors found it necessary to order a reduction of discounts to the amount of 5,000,000. In October, an additional reduction of 2,000,000 was ordered to be made. But these measures had not the effect anticipated. On the 1st of February 1819, serious apprehensions were entertained that the bank would be obliged to suspend specie payments, and these apprehensions were not entirely removed before the 7th of May. The bank was then considered out of danger: but, through the course which business took, the amount loaned on private security was further reduced. From Febuary 21st 1818 to December 31st 1819, the reduction of the amount of loans on private security, exceeded 12,000,000 dollars: or, was nearly equal to the amount of the public debt, forming part of the capital of the bank, which the secretary of the treasury redeemed in six months after the bank commenced operations.

Mr. Crawford, writing in 1819, said, "few instances are on record of sufferings so deep and extensive as those which have overspread the United States." The particulars of the sufferings he alludes to, would belong to a history of banking rather than to a history of finances. We can treat of them here, so far only as they were connected with the immediate operations of government. Suffice it to state, that it was not till 1820-21, that business was brought in the middle states into the condition in which it was before the war; and that the confusion in the western, and in some parts of the southern states, was not over till 1825, or 1826.

It is not unusual to ascribe these sufferings to errors in the early administration of the Bank of the United States, in connexion with the operations of the local banks in the same period, and in previous years. But this is giving only the instrumental cause. The *efficient* cause is to be found in the financial policy of 1812-14—that policy which led us to attempt to carry on a war with the most powerful nation on the globe, on a revenue of twelve million dollars. Our expenditures in time of peace were eight millions, including the interest on the national debt, and with the remaining four millions we sought to defray the expense of fleets and armies. The only way in which so inconsiderable a disposable revenue could be made to serve the purposes intended, was by borrowing bank-notes and bank credit, by creating a double debt; a debt, in the first place, from the government to the banks, or the borrowers from the banks; and, in the second place, a debt from the banks to the people to whom government transferred the bank notes and bank credits. To supply the exigences of the government, and to increase their own profits, the banks issued more notes than they could redeem; and that the system should continue, it was necessary that the banks should not press the government for payment, nor the people press the banks.

The accounts which have been published of the exports of specie in the year after the war, show that the banks in the principal sea-ports had the power to resume their regular course of business on the return of peace. Bank paper being in no small degree indebted for its circulating quality to the fact of its being receivable in payment of dues to government, an order to the collectors of public moneys not to receive any notes except such as could on demand be exchanged for specie, would, in one month, have overcome the reluctance of the principal institutions to resume specie payments, and the others would gradually have imitated their example. As government had, previous to the close of the war felt the inconvenience of a diversified currency, its neglect to apply so simple and so obvious a remedy, can be ascribed only to its fiscal embarrassments. Institutions which are founded for private profit, must always be expected to take advantage of so many opportunities for acquiring gain, as the policy of government will allow, or its necessities compel it to afford. They pay for their privileges, and the courts of law have, we believe, decided that charters are always to be construed in the manner most favourable to the grantees. The government's receiving "inconvertible" paper, in payment of duties, was quite as efficient a sanction of the continued suspension of specie payments, as could have been afforded by an act of Congress passed expressly with that intent: and it ought to excite no surprise, that, when the practical sanction of the supreme authority was given to the use of "inconvertible" paper, the banks should greatly increase their issues. Nor did they alone profit by the "plentifulness of money." To this cause we must attribute the net revenue of eighty millions for the years 1816 and 1817. The "inconvertibility" of the immense balances in the treasury at the end of the years 1815, 16, and 17, did, indeed, render it difficult to satisfy the public creditors in those parts of the country where specie only would be received, but, without "inconvertible" paper, it would not have been easy to satisfy the public creditors in any part of the country. It was through the depreciation of the currency in the years subsequent to the war, that the government was so soon able to discharge between twenty and thirty millions of debt.

Those peculiarities in the constitution of the United States Bank, which rendered its operations less beneficial than were expected, are also to be ascribed to the embarrassments of government. It was that a large amount of government stock might be absorbed, that an institution was established with so large a capital as thirty-five millions, when there was hardly room for a bank with a capital of five millions. The charter was, as has already been observed, granted in April 1816, when government securities were below par. By converting a large portion of them into bank stock, the outstanding debt was funded on more favourable terms than would otherwise have been practicable: but by creating a bank with so large a capital, a necessity was imposed of doing a very great business, or else of making dividends much below the usual rate.

Much has been said of the manner in which the payment of the second and third instalments of the subscription was effected; but if the members of Congress did not know that the usual way of paying all instalments after the first, is by discounting the stock notes of the subscribers, they had not much acquaintance with either the theory or the history of banking. It was not, surely, to be expected, that men who associated with the professed design of making profit for themselves, and who paid a heavy bonus for their privileges, should depart from established usage, and trammel themselves with restrictions which the legislature had, either through policy or oversight, failed to impose.

Banks being the creatures of government, if there are any faults in their constitution, the blame must be laid on the supreme authority.

A bank with a capital of about two millions in specie, twenty-one millions in evidences of public debt, and twelve millions in evidences of private debt, or stock-notes of the subscribers, was expected to perform what could have been effected only by a bank having a capital of thirty-five millions in specie, all paid in on the day on which it commenced operations. So unreasonable an expectation must necessarily have been disappointed: but, notwithstanding the manner in which the bank was constituted, the reaction which began in 1818 would not have occurred, if so large a portion of the public stocks which constituted part of the original capital of the bank, had not been exchanged for the depreciated paper in the United States treasury. We have seen that, when the reduction of private loans on private security was greatest, it did not equal the amount of public stock, which the bank was obliged to transfer to the government in six months after it began business.

There is no intention here of casting a personal censure on the men with whom the financial policy of 1812—14 originated. But in the reprobation of the principles of that policy, all must unite, when they see it was that which led to the suspension of specie payments, to the inordinate multiplication of bank-paper, to the reaction of 1818, and the commercial difficulties of subsequent years.

At the close of the year 1818, the balance in the treasury was reduced to $1,478,526, a great part of which was in paper, which no fiscal ingenuity could transmute into gold and silver. Appearances were at times very discouraging, but the receipts of the treasury in the whole of 1819 were sufficient to defray the current expenses of the year, and discharge upwards of $4,000,000 of the public debt.

In 1820 the revenue from the customs was reduced to $15,000,000, and the public lands yielded but half as much as they had yielded in 1819. The bank of the United States paid 1,000,000, being the second and third instalments of its bonus: and a small amount was received for arrears of internal and direct taxes. The clear revenue of the year, independent of loans, was 17,800,000, which was sufficient, after paying current expenses, to reduce the national debt in the extent of 1,000,000. The payment of the last instalment of the Louisiana loan, and the reimbursement of a portion of the old six per cent and deferred stocks, rendered it necessary to borrow 3,000,000 dollars: but this was merely changing the form of debt, not increasing it. The total of the debt was actually reduced, as has already been stated, by the revenue exceeding the current expenses, in the amount of 1,000,000.

In 1821 the customs yielded 13,000,000, being one half as much as they had yielded in 1817. The whole revenue of the government, from all sources except loans, was 14,500,000 equal to one-fourth of the net revenue of 1816. It became necessary to negotiate a loan of 5,000,000, which, owing to the want of profitable employment for capital in business, was obtained on very favourable terms. The money was borrowed at five per cent, and the lenders gave a premium on the average of nearly five dollars fifty-nine one-hundredths per cent. This rendered it necessary to issue new stock to the amount of only 4,735,296 dollars 20 cents. A portion of the old six per cent and deferred stock having been reimbursed during the year, the net increase of debt was less than 4,000,000.

Through the system of granting a credit on duties, events which diminish or increase the import trade, have not their complete effect on the revenue from the customs till some time after they have begun to operate on commerce. The demands on the treasury in 1819 were met, to a great extent, by the receipt of duties which had accrued during the preceding year. The revenue in 1819 was further increased by speculations in the public lands, which the previous abundance of money had in part occasioned. In 1819 the receipts at the treasury on account of the public lands amounted to 3,270,000 dollars, a greater sum than has been received in any one year, either before or since. In 1820 the effect of the commercial reaction, which began in 1818, was felt in a very sensible degree by government in the reduction of the revenue both from customs and from the public lands. In the first quarter of 1821 the customs reached their lowest point of depression: and the utter inability of many of the purchasers of public lands to comply with their engagements, induced Congress to pass a law to relieve them from a part of their obligations.

In the second quarter of 1821 the import trade began to revive. The violent effects of the reaction were over in those parts of the union where the greatest portion of the public revenue is collected.

In 1822, owing to the revival of the import trade, the revenue from the customs was increased to 17,000,000, and the balance in the treasury at the end of the year was upwards of 4,000,000. The greater part of this balance consisted of money of a kind which could be applied to any purposes the public service might require; and from this time we may date the regular and rapid reduction of the national debt.

In 1823 the revenue from the customs increased to 19,000,000, and the published accounts showed a reduction in the public debt of between two and three millions, and a balance in the treasury at the end of the year of nearly 9,500,000.

An unsuccessful attempt was made under authority of an act passed in April 1822, to exchange twenty-six millions of the six and seven per cents, which were reimbursable in 1825, 26, 27 and 28, for a five per cent stock, reimbursable at a later period. The holders of stock to the amount of only 56,704 dollars, accepted the terms offered by Congress.

Efforts of this kind were repeated in 1824 and 1825, and were then more successful, though not to the extent anticipated. In 1824 nearly four millions and a half, and in 1825 upwards of one million and a half of the six per cent war-stocks were exchanged for stocks bearing an interest of four and a half per cent.

In 1824 a loan of five millions at four and a half per cent was negotiated with the United States bank, to satisfy the claimants under the Florida treaty. The surplus of moneys in the treasury was applied to the reimbursement of the seven per cent stock, to the reimbursement of the last remains of the old six per cent and deferred stocks, and of all but a very small part of the six per cent exchanged stock of 1812. The published accounts showed a reduction in the total amount of public debt, in the course of the year, of between six and seven millions.

In 1825 the sum of five million dollars was borrowed from the United States bank at four and a half per cent, to facilitate the payment of the six per cent stock of 1812: and upwards of a million and a half of six per cent stocks of other years were, as mentioned above, exchanged for stock bearing an interest of four and a half per cent. Since that time the operations of the treasury department have been conducted without incurring any new, or changing the form of any old debts: and, owing to the prosperous state of the revenue, the public debt has been reduced with a rapidity which the experience of other years gave the people no reason to expect.

From the 1st of January 1824 to the 1st of January 1828, the principal of the debt was reduced nearly twenty-three millions of dollars. From the first of January 1828 to the first of January 1832, the reduction was upwards of forty-three millions.

In the tables annexed to this article, the reader will find a view of the receipts and expenditures of government from the 4th of March 1789 to the 31st of December 1791, and from the 1st of January to the 31st of December, for each year, from 1792 to 1829, both inclusive.

We give these tables in the form in which they were presented to the chairman of the committee on retrenchment in April 1830: and add a statement of the receipts and expenditures in 1830 and 1831, with an estimate for 1832, taken from subsequent reports of the treasury department.

In 1830 the receipts were:	
From the Customs, .	$21,922,391 39
Public lands, .	2,329,256 14
Dividends on bank stock, .	490,000 00
Incidental receipts .	102,368 98
Total .	$24,844,116 51

The expenditures in the same year were,	
On account of civil list, foreign intercourse, and miscellanies,	3,237,416 04
Military service, .	6,752,688 66
Naval service, . .	3,239,428 63
Public debt, . .	11,355,748 22
Total .	$24,585,281 55

The balance in the treasury on the 1st of January 1831 was,	$6,014,539 75

The secretary of the treasury in his report at the commencement of the session of Congress of 1831-2, from the returns of three-quarters, and a calculation of the probable returns of the fourth quarter, estimated the total revenue of the year 1831 at 28,000,412 dollars 87 cents: the expenditures at 30,967,201 dollars 25 cents, (of which 16,189,289 dollars 67 cents were in payment of principal and interest of the public debt,) and the balance in the treasury on the 1st of January 1832 at 3,047,751 dollars 37 cents. Of this last amount 1,400,000 consist of funds which are not effective, being bank-notes received during the suspension of specie payments, and debts due from broken banks in which the public money was deposited.

This statement of the receipts and expenditures of 1831, is liable to the corrections which the secretary of the treasury may make in his report at the commencement of the session of congress of 1832–33.

The total receipts of the year 1832 the secretary of the treasury estimates at 30,100,000 dollars, viz.

From the customs, - - -	26,500,000 00
Public lands, - - -	3,000,000 00
Bank dividends, - - -	490,000 00
Incidental receipts, - - -	110,000 00

The expenditures he estimates at 13,365,202 dollars 26 cents, viz.

On account of the civil list, foreign intercourse, and miscellanies,	2,809,484 26
Military service, - - - -	6,648,099 19
Naval service, - - -	3,907,618 71

The surplus of revenue, with the balance in the treasury at the beginning of the year, will be sufficient to redeem all the three per cent and such other stocks as are by the terms of contract reimbursable in this period. If the money should be applied in this way, the national debt at the end of the year will be about ten millions of dollars.

The public debt on the 2d of January 1832 was as follows:

1. *Funded Debt.*

Three per cent stock created by act of August 1790, redeemable at the pleasure of government, -	13,296,626 21
Five per cents of March 1821, redeemable after first of January 1835, - - - - - -	4,725,296 30
Five per cents (exchanged) of April 20, 1822, one-third redeemable annually after the 31st of December 1830, 31, and 32, - - -	56,704 77
Four and a half per cents of May 24th, 1824, redeemable after the first of January 1832, - - - - -	1,739,524 01
Four and a half per cents (exchanged) of May 26th, 1824, one half redeemable after the 31st of December 1832, the residue after the 31st of December 1833, - - -	4,454,727 95
Total of funded debt, -	$24,282,879 24

2. *Unfunded Debt.*

Registered debt, being claims registered prior to the year 1798, for services and supplies during the revolutionary war, - -	27,919 85
Treasury Notes, - - -	7,116 00
Mississippi stock, - - -	4,320 09
Total of unfunded debt, - -	$39,355 94
Making the whole amount of the public debt of the United States,	$24,322,235 48

By the 2d of January 1835, the whole debt may be discharged.

The principal revenue of the United States government is from the duties on imports and tonnage. The public lands have not yet reimbursed the cost of extinguishing the aboriginal title and the expenses of surveying. The post office yields nearly two millions a year, but nearly all it produces is expended in extending the mail routes.

The following view of the receipts and expenditures of eleven of the state governments, in 1828, has been formed from the tables published in the American Almanac for 1830.

	Receipts.	Expenditures.
Maine,	144,185	137,351
New Hampshire,	78,058	80,890
Vermont,	31,178	51,683
Massachusetts,	240,026	304,471
Connecticut,	68,604	74,953
New York,	1,938,006	1,988,084
Pennsylvania,	547,370	497,546
Maryland,	221,036	267,002
North Carolina,	68,703	80,890
Georgia,	181,155	186,929
Missouri,	59,570	33,679

Amounts received on loan are not included in the statement here given of receipts: and the expenditures of Pennsylvania are independent of those made with borrowed money in constructing canals and rail roads.

The revenues of the state governments are derived, for the most part, from bank dividends, taxes on banks, taxes on auctions, licenses to retailers and tavern-keepers, in some instances a direct tax on property, and from sales of land.

The principal expenditures of the state governments are in payments of the expenses of the legislature, the salaries of the chief officers of the state, and in the extension of roads and canals. The funds for the last mentioned object are usually obtained by borrowing.

The county, city, town, and township expenses, including the support of the poor, are in the aggregate very considerable: but the amount we have not the means of ascertaining. These include many of the expenses of the administration of justice, and of keeping the common roads in order. Many of the expenses of litigation are defrayed by fees paid by the parties. Of the amount of these fees, no general statement is ever rendered.

An estimate was made a few years since, that the people of the city and county of Philadelphia paid annually between three and four millions of dollars for the support of government. In this estimate were included the duties paid to the United States government on foreign commodities consumed within the city and county, the taxes paid to the state government, all the various municipal expenses, including the support of the poor, and the diversified fees paid to public officers. The inhabitants of the interior consuming a less amount of foreign commodities, pay fewer taxes: and the municipal expenses of but few districts are as great as those of Philadelphia.

In European governments, many of the items of our state and county disbursements, enter into the general statement of national expenditures. From not attending to this fact, some writers have given very incorrect views of the relative amount of taxes paid by the people of Europe and America: and have contrasted the amount expended by us principally in providing means of external defence, and in regulating foreign intercourse, with the expenses of general government in other countries. A correct estimate of the relative expenses of government in different countries is a desideratum, which it is not easy to supply. All our expenditures, national, state, and municipal, may be esteemed moderate when compared with those of England: but perhaps it would be possible to reduce the total amount without diminishing the protection afforded to persons and property. The art of governing well, is, not to govern too much, an art in which some advances have been made, but which is not yet brought to perfection. In proportion as this art advances the expenses of government will be lessened, without its efficiency for good being in any degree diminished.

TABLE LXI.

A Table showing the amount of the public debt of the United States on the 1st *of January of each year, from* 1791 *to* 1832, *both inclusive.*

1791.	$75,169,724	General Washington's administration began March 4th, 1789, and ended March 3d, 1797. The debt was increased after the 1st of January 1791, by funding additional amounts of the revolutionary claims : by the Indian war, the western insurrection, the transactions with the Barbary powers, and other events which occasioned a great expenditure.
1792.	76,373,767	
1793.	77,537,967	
1794.	75,996,170	
1795.	78,149,937	
1796.	81,642,272	
1797.	80,934,043	
1798.	78,494,165	Mr. John Adams's administration commenced March 4th, 1797, and ended March 3d, 1801. The debt was increased by the warlike preparations made in consequence of the dispute with France.
1799.	77,399,909	
1800.	81,633,325	
1801.	82,000,167	
1802.	78,754,568	Mr. Jefferson's administration began March 4th, 1801, and ended March 3d, 1809. The debt was increased in 1804 by the purchase of Louisiana, for the sum of 15,000,000 dollars. Reduced in the subsequent years by the abundant revenue derived from commerce.
1803.	74,731,922	
1804.	85,353,643	
1805.	80,534,058	
1806.	74,542,957	
1807.	67,731,645	
1808.	64,742,326	
1809.	56,732,379	
1810.	53,156,532	Mr. Madison's administration commenced March 4th, 1809, and ended March 3d, 1817. War was declared in July 1812. The ratifications of peace were exchanged in February 1815. The debt greatly increased by the events of the war. The Mississippi stock, which had been issued under an act of 1814, and the amount of which exceeded four millions of dollars, first included in the general statement in 1817.
1811.	47,855,070	
1812.	45,035,123	
1813.	55,907,452	
1814.	80,986,291	
1815.	99,824,410	
1816.	123,016,375	
1817.	123,491,965	
1818.	103,466,633	Mr. Monroe's administration began March 4th, 1817, and ended March 3d, 1825. The debt diminished in the first years of his first term by the abundance of paper-money revenue. Increased afterwards by the diminution of the revenue, occasioned by the resumption of specie payments. An addition of nearly five millions made to the debt in 1824, by the purchase of Florida : but the total amount reduced by the abundance of the revenue.
1819.	95,529,648	
1820.	91,015,566	
1821.	89,987,427	
1822.	93,546,676	
1823.	90,875,877	
1824.	90,269,777	
1825.	83,788,432	
1826.	81,054,059	Mr. John Quincy Adams's administration began March 4th, 1825, and ended March 3d, 1829. The debt diminished through the causes which began to be effective in the last year of Mr. Monroe's second term.
1827.	73,987,357	
1828.	67,475,622	
1829.	58,362,135	
1830.	48,565,405	General Andrew Jackson's administration began March 4th, 1829. The debt diminished through the continued operation of the causes which began to be effective in the last year of Mr. Monroe's second term.
1831.	39,082,451	
1832.	24,322,235	

TABLE LXII.

Receipts of the United States from March 4, 1789, *to December* 21, 1829; *as stated in a Letter from the Secretary of the Treasury to the Chairman of the Committee on Retrenchment, April* 9, 1830.

Years from March 4, 1789, to	Customs.	Internal Revenue.	Direct Taxes.	Postage.	Public Lands.	Loans and Treasury Notes, &c.	Dividends and sales of Bank Stock & Bonds.	Miscellaneous.	Total.
Dec. 31. 1791	$4,399,473 09					$5,791,112 56		$19,440 10	$10,210,025 75
" 1792	3,443,070 85	$208,942 81				5,070,806 46	$8,028 00	9,918 65	8,740,766 77
" 1793	4,255,306 56	337,705 70		$11,020 51		1,067,701 14	38,500 00	10,390 37	5,720,624 28
" 1794	4,801,065 28	274,089 62		29,478 49		4,609,196 78	303,472 00	23,799 48	10,041,101 65
" 1795	5,588,461 26	337,755 36		22,400 00		3,305,268 20	160,000 00	5,917 97	9,419,802 79
" 1796	6,567.987 94	475,289 60		72,909 84	$ 4,836 13	362,800 00	1,240,000 00	16,506 14	8,740,329 65
" 1797	7,549,649 65	575,491 45		64,500 00	83,540 60	70,135 41	385,220 00	30,379 29	8,758.916 40
" 1798	7,106,061 93	641,357 05		39,500 00	11,963 11	308,574 27	79,920 00	18,692 81	8,209,070 07
" 1799	6,610,449 31	779,136 44		41,000 00		5,074,646 53	71,040 00	45,187 56	12,621,459 84
" 1800	9,080,932 73	809,396 53	$734,223 97	78,000 00	443 75	1,602,435 04	71,040 00	74,712 10	12,451,184 14
" 1801	10,750,778 93	1,048,033 43	534,343 38	79,500 00	167,726 06	10,125 00	88,800 00	266,149 15	12,945,455 95
" 1802	12,438,235 74	621,898 89	206,565 44	35,000 00	188,628 02	5,597 36	1,327,560 00	177,905 86	15,001,391 31
" 1803	10,479,417 61	215,179 69	71,879 20	16,427 26	165,675 69			115,518 18	11,064,097 63
" 1804	11,098,565 33	50,941 29	50,198 44	26,500 00	487,526 79	9,532 64		112,575 53	11,835,840 02
" 1805	12,936,187 04	21,747 15	21,883 91	21,342 50	540,193 80	128,814 94		19,039 80	13,689,508 14
" 1806	14,667,698 17	20,101 45	55,763 86	41,117 67	765,245 73	48,897 71		10,004 19	15,608,823 78
" 1807	15.845,521 61	13,051 40	34,732 56	3,614 73	466,163 27			34,935 69	16,398,019 26
" 1808	16,363,550 58	8,210 73	19,159 21		647,939 06	1,822 16		21,802 35	17.062,544 09
" 1809	7,296,020 58	4,044 39	7,517 31		442,252 33			25,638 51	7,773,473 12
" 1810	8,583.309 31	7,430 63	12,448 68		696,548 82	2,759.992 25		84,476 84	12,144,206 53
" 1811	13,313,222 73	2,295 95	7.666 66	37 70	1,040,237 53	8,309 05		60,068 52	14,431,838 14
" 1812	8,958,777 53	4,903 06	859 22	85,039 70	710,427 78	12,837,900 00		41,125 47	22,639,032 76
" 1813	13,224.623 25	4,755 04	3,805 52	35,000 00	835,685 14	26,184,435 00		236.571 00	40,524,844 95
" 1814	5.998,772 08	1,662,984 82	2,219.497 36	45,000 00	1,135,971 09	23,377,911 79		119,399 81	34.559,536 95
" 1815	7,282.942 22	4,678,059 07	2,162,673 41	135,000 10	1,287,959 28	35,264,320 78		150,282 74	50,961,237 60
" 1816	36,306,874 88	5,124,708 31	4,253,635 09	149,787 74	1,717,985 03	9,494.436 16		123,994 61	57,171,421 82
" 1817	26.283.348 49	2,678,100 77	1,834,187 04	29,371 91	1,991,226 06	734,542 59	202,426 30	80.389 17	33,833,592 33
" 1818	17,176,385 00	955,279 20	264,333 36	20,070 00	2,606,564 77	8,765 62	525,000 00	37,547 71	21.593,936 66
" 1819	20,283,608 76	229,593 63	83,650 78	71 32	3,274,422 78	2,291 00	675.000 00	57,027 10	24.605,665 37
" 1820	15,005.612 15	106,260 53	31,586 82	6,465 95	1,635,871 61	3,040,824 13	1,000,000 00	54,872 49	20.881,493 68
" 1821	13 004,447 15	69.027 63	29,349 05	516 91	1,212,966 46	5,000,324 00	105,000 00	152,072 52	19 573,703 72
" 1822	17,589,761 94	67,665 71	20,961 56	602 04	1,803,581 54		297,500 00	452,355 15	20.232.427 94
" 1823	19,088,433 44	34,242 17	10,337 71	110 69	916,523 10		350,000 00	141,019 15	20.540.666 26
" 1824	17,878.325 71	34,663 37	6,201 96		984,418 15	5,000,000 00	350.000 00	127,603 60	24.381.212 79
" 1825	20.098,713 45	25,771 35	2,330 85	469 56	1,216,090 56	5,000,000 00	367,500 00	129 982 25	26.840.858 02
" 1826	23,341,331 77	21,589 93	6,638 76	300 14	1,393,785 09		402,500 00	94,288 52	25.260.434 21
" 1827	19,712,283 29	19,885 68	2,626 90	101 00	1,495,845 26		420,000 00	1,315,621 83	22.966,363 96
" 1828	23.205,523 64	17,451 54	2,218 81	20 15	1,018,308 75		455,000 00	65,106 34	24,763.629 23
" 1829	22.681,965 91	14,404 74	11,321 29		1,457,004 66		490,000 00	112.425 62	24.767.122 22
	520,296.996 89	22.204,438 03	12,702,597 11	1,090,275 91	32,403,527 80	156,181,578 57	9,413,506 30	4,672,744 17	758,965,664 78

TABLE LXIII.

Expenditure of the United States from March 4, 1789, to December 21, 1829; as stated in a Letter from the Secretary of the Treasury to the Chairman of the Committee on Retrenchment, April 9, 1830.

Years. From March 4, 1789, to Dec 31,	Civil List.	Foreign Intercourse.	Miscellaneous.	Public Debt.	Naval Establishment.	Military Establishment.				Total.	Balances in the Treasury at the end of each year.
						Mil. Serv. including Fortifications, Arsenals, Armories, Ordnances, Internal Improvements, &c.	Revolutionary Pensions.	Other Pensions.	Indian Department.		
1791	$757,134 45	$14,733 33	$311,533 83	$5,287,949 50	$ 570 00	$632,804 03		$175,813 88	$27,000 00	$7,207,539 02	$973.905 75
1792	380,917 58	78,766 67	194,572 32	7,263,665 99	53 02	1,100,702 09		109,243 15	13,648 85	9,141,569 67	783.444 51
1793	358,241 08	89,500 00	24,709 46	5,819,505 29		1,130,249 08		80,087 81	27,282 83	7,529,575 55	753,661 69
1794	440.946 58	146,403 51	118,248 30	5,801,578 09	61,408 97	2,639,097 59		81,399 24	13,042 46	9,302,124 74	1,151,924 17
1795	361,633 36	912,685 12	92,718 50	6,084,411 61	410,562 03	2,480,910 13		68,673 22	23.475 68	10.435,069 65	516.442 61
1796	447,139 05	184,859 64	150,476 14	5,835,846 44	274,784 04	1,260,263 84		100,843 71	113,563 98	8,367,776 84	888.995 42
1797	483,233 70	669,788 54	103,880 82	5,792,421 82	382,631 89	1,039,402 66		92.256 97	62.396 38	8,626.012 78	1,021,899 04
1798	504.605 17	457,428 74	149,004 15	3,990,294 14	1,381,347 76	2,009,522 30		104,845 33	16,470 09	8,613.517 68	617,451 43
1799	592.905 76	271,374 11	175,111 81	4,596,876 78	2,858,081 84	2,466,946 98		95,444 03	20,302 19	11,077,043 50	2,161,867 77
1800	748.688 45	395,288 18	193,636 59	4,578.369 95	3,448,716 03	2,560,878 77		64,130 73	31 22	11,989,739 92	2,623,311 99
1801	549.288 31	295,676 73	269,803 41	7,291,707 04	2,111,424 00	1,672,944 08		73,533 37	9,000 00	12,273.376 94	3,295,391 00
1802	596,981 11	550,925 93	315,022 36	9,539,004 76	915,561 87	1,179,148 25		85,440 39	94,000 00	13,276,084 67	5,020,697 64
1803	526.583 12	1,110.834 77	205.217 87	7,256,159 43	1,215,230 53	822,055 85		62,902 10	60,000 00	11,258.983 67	4,825,811 60
1804	624.795 63	1,186,655 57	379,558 23	8,171.787 45	1,189,832 75	875,423 93		80,092 80	116,500 00	12.624,646 36	4,037,005 26
1805	585.819 79	2,798,023 77	334,720 19	7,369,889 79	1,597,500 00	712,781 28		81,854 59	196,500 00	13,727.124 41	3.999,388 99
1806	681,230 53	1,760,121 30	445,485 18	8,989,884 61	1,649,641 44	1,224,355 38		81,875 53	234,200 00	15,070,093 97	4,538,123 80
1807	655,524 65	577,826 34	464,546 52	6,307,720 10	1,722,064 47	1,288,685 91		70,500 00	205,425 00	11,292,292 99	9,643,850 07
1808	691,167 80	301,992 83	427,124 98	10,260.245 35	1,884,067 80	2,900,834 40		82,576 04	213,575 00	16,764,584 20	9,941,809 96
1809	712,465 13	166.306 04	337,032 62	6,452.554 16	2,427,758 80	3,345,772 17		87,833 54	337.503 84	13,867,226 30	3,848,056 78
1810	703.994 05	81.367 48	315,783 47	8,008,904 46	1,654,244 20	2,294.323 94		83,744 16	177,625 00	13.319,986 74	2,672,276 57
1811	644,467 27	261 901 47	457,919 66	8,009,204 05	1,965,566 39	2,032,828 19		75,043 88	151,875 00	13,601,808 91	3,502,305 80
1812	826,271 55	347,703 29	509,113 37	4,449,622 45	3,959,365 15	11,817,798 24		91,402 10	277,845 00	22.279.121 15	3,862,217 41
1813	780.545 45	209.941 01	738,949 15	11,108,128 44	6,446,600 10	19,652,013 02		86,989 91	167,358 28	39,190.520 36	5,196,542 00
1814	927,424 23	177,179 97	1,103,425 50	7,900,543 94	7,311,290 60	20,350,806 86		90.164 36	167,394 86	38,028.230 32	1,727,848 65
1815	852,247 16	290,892 04	1,755,731 27	12,628,922 35	8,660,000 25	14,794,294 22		69.656 06	530,750 00	39,582,493 35	13,106,592 88
1816	1,208.125 77	364,620 40	1,416,995 00	24,871,062 93	3,908,278 30	16,012,096 80		188,804 15	274,512 16	48.244,495 51	22,033,519 19
1817	994.556 17	281.995 97	2,242,384 62	25,123,036 12	3,314,598 49	8,004,236 53		297,374 43	319,463 71	40,877,646 04	14.989,465 48
1818	1,109,559 79	420.429 90	2,305,849 82	21,296,201 62	2,953,695 00	5,622,715 10	$300,000 00	590.719 90	505,704 27	35,104,875 40	1,478,526 74
1819	1,142,180 41	284,113 94	1,640,917 06	7,703,926 29	3,847,640 42	6,506,300 37	1,847,900 85	568,039 00	463,181 39	24,004,199 73	2,079,992 38
1820	1,218,310 05	253,370 04	1,090,341 85	8,628,494 28	4,387,990 00	2,630,392 31	2,766,440 00	441,936 31	315,750 01	21,763.024 85	1,198,461 21
1821	1,112.292 64	207,110 75	903,718 15	8,367,093 62	3,319,243 06	4,461,291 78		242,817 25	477,005 44	19.090,572 69	1,681,592 24
1822	1,158,131 58	164.879 51	644,935 15	7,848,949 12	2,224,458 98	3,111,981 48	1,642,590 94	305,608 46	575,007 41	17.676,592 63	4,237,427 55
1823	1,058.911 65	292,118 56	671,063 78	5,530,016 41	2,503,765 83	3,096,924 43	1,449,697 04	331,491 48	380,781 82	15.314,171 00	9,463,922 81
1824	1,336,266 24	5,110,099 83	678,942 74	16,568,393 76	2,904,581 56	3,340,939 85	1,267,600 41	231,726 18	429,987 90	31,898.538 47	1.946,597 13
1825	1,330,747 21	371,666 25	1,046,131 40	12,095,344 78	3,049,083 86	3,659,914 18	1,308,810 57		724,106 44	23,585.804 72	5,201,650 43
1826	1.256.745 48	232.719 08	1,110,713 23	11,041,082 19	4,218,902 45	3,943,194 37	1,305,194 82	251,399 01	743,447 83	24,103,398 46	6,358,686 18
1827	1,228,141 04	659,211 87	826,123 67	10,003.668 39	4,263,877 45	3,938,977 88	796,012 52	180,126 84	760,624 88	22.656,765 04	6,668,286 10
1828	1,455.490 58	1,001.193 66	1,219,368 40	12,163,438 07	3,918,786 44	4,145,544 56	723,134 80	127,438 77	705,084 24	25,459,479 52	5,972,435 81
1829	1.523,966 86	207,060 35	1,570,656 66	12,383.800 77	3,312,931 87	4,730 605 05	767,492 38	185,344 26	589,159 41	25,071,017 59	5,668,540 44
	32,400,706 44	23,225,074 49	26,991,517 23	362,719,701 34	101,656,137 64	175,489,957 86	14,174,274 33	6,119,172 44	10,520,582 57	753,297,124 34	

CURRENCY AND BANKS.

The currency of the United States consists of gold and silver coin, either stamped at the Mint of the United States or made a legal tender by act of Congress; and bank-notes convertible on demand into coin.

The amount of coin stamped at the Mint within the last year, together with the general operations of the establishment within that period, are stated in the following report of the director of the Mint.

" The coinage effected within the year 1831 amounts to $3,922,473 60, comprising $714,270 in gold coins, $3,175,600 in silver, $33,603,60 in copper, and consisting of 11,792,284 pieces of coin, viz.

Half Eagles	140,594	pieces, making	$702,970 00
Quarter Eagles	4,520	- -	11,300 00
Half Dollars	5,873,660	- -	2,936,830 00
Quarter Dollars	398,000	- -	99,500 00
Dismes	771,350	- -	77,135 00
Half Dismes	1,242,700	- -	62,135 00
Cents	3,359,260	- -	33,592 60
Half Cents	2,200	- -	11 00
	$11,792,248		3,923,473 60

"Of the amount of gold coined within the past year about $130,000 were derived from Mexico, South America and the West Indies, $27,000 from Africa, $518,000 from the gold region of the United States, and about $39,000 from sources not ascertained.

" Of the amount of gold of the United States above mentioned about $26,000 may be stated to have been received from Virginia, $294,000 from North Carolina, $22,000 from South Carolina, and $176,000 from Georgia. Gold has been received also within the past year from Tennessee and Alabama, not exceeding, however, $1000 from each of those states, an amount meriting little regard except as indicating the progressive development of the gold region.

" The first notice of gold of the United States on the records of the Mint occurs in the transactions of the year 1804. From that year to 1823 inclusive, the average annual amount received at the Mint did not exceed $2500. Since the latter period the progressive increase has been remarkable. The amount received within the succeeding years to the present time may be stated as follows:

In 1824 . .	$5,000
1825 . .	17,000
1826 . .	20,000
1827 . .	21,000
1828 . .	46,000
1829 . .	134,000
1830 . .	466,000
1831 . .	518,000

"Previously to the year 1829, the state of North Carolina had furnished gold to the Mint. Within that year it was received also from Virginia and South Carolina, viz. from the former $2500, and from the latter $3500. Early in 1830 gold began to be received from Georgia. The amount derived within that year from the various sections of the gold region was as follows: Virginia $24,000, North Carolina $204,000, South Carolina $26,000, and Georgia $212,000.

" Silver bullion has been supplied throughout the year in quantities amply sufficient for our present power. The coinage of silver alone has exceeded the whole amount of coinage in any former year, and the coinage of gold, silver, and copper has exceeded that of any previous year by nearly a million of dollars.

" The employment of copper coins in circulation is becoming obviously more general than heretofore. They are transmitted at the public expense and risk to all parts of the United States within the ordinary means of transportation, and their use and value are becoming familiar and acknowledged, where until recently they have been in little estimation.

" The profit on the copper coinage of the past year will somewhat exceed $10,000. This profit is regularly accounted for to the treasury of the United States, thereby refunding so much of the sum appropriated for the expenses of the Mint establishment. The whole expenditure of the Mint for the past year will then be reduced to less than $28,000."

" Should the supply of bullion be regular and competent, it is not doubted that the amount of coinage for the present year will be equal to six millions of dollars. Of this amount it is proposed to make such a proportion of denominations less than the half dollar as will sensibly improve the condition of the currency."

Besides these, the coins of foreign countries circulate at certain rates prescribed by act of Congress. As these are not merely used as circulating medium, but are objects of foreign commerce, the stock in the country constantly varies with the state of trade, and it is difficult to form any estimate of the amount now in actual circulation. That part of the currency which consists of bank-notes can be more readily ascertained.

The banking system of the United States is simply this: The legislatures of the several states exercise the power of granting charters of incorporation for banks, which are created by a subscription of individual capital, the subscribers having no personal liability beyond the amount contributed by each, and the corporation under the management of a Board of Directors, chosen for the most part annually, proceed to lend out this accumulated capital, receive deposits, and issue notes payable on demand in gold or silver.

The number, the capitals, the notes and the specie of these banks, as far as they have been ascertained, are stated in the excellent work by Mr. Gallatin on banks and currency, from which we extract the following interesting table:

TABLE LXIII.

1st *January* 1830.

States.	No. of Banks.	Capital.	Circulation.	Deposits.	Specie.	Loans.
Massachusetts	66	20,420,000	4,747,784	2,545,230	987,213	28,590,894
Maine	18	2,050,000	549,110	497,072	208,921	2,565,256
New Hampshire	18	1,791,670	743,457	173,682	226,428	2,466,291
Vermont	10	432,625	680,379	124,880	428,817	856,814
Rhode Island	47	6,118,397	673,836	861,031	343,389	6,909,705
Connecticut	10	3,692,577	1,503,460	452,444	337,788	4,195,690
New York	30	15,637,353	7,959,280	10,354,500	1,560,291	20,370,693
New Jersey	5	844,284	374,799	307,201	83,667	1,153,407
Pennsylvania	*32	12,810,333	7,308,368	6,841,448	2,414,669	21,474,173
Delaware	4	830,000	376,000	300,000	170,000	not known.
Maryland	9	5,525,495	1,733,659	1,864,397	777,009	6,627,270
District of Columbia	9	3,875,794	946,059	564,894	228,914	3,837,272
Virginia	4	5,571,100	3,857,964	1,974,171	832,732	7,698,906
North Carolina	3	3,195,000	1,431,543	452,389	179,268	4,621,810
South Carolina	1	1,156,000	1,175,000	793,000	129,000	2,605,504
Georgia	9	4,203,029	2,719,356	1,382,634	1,305,141	6,252,474
Louisiana	3	4,665,980	1,301,483	2,016,560	1,492,674	6,796,351
Alabama	1	495,503	522,637	136,656	127,596	237,060
Mississippi	1	950,600	540,190	547,756	77,665	1,927,435
Tennessee	1	737,817	30,550	339,174	78,461	628,436
	281	95,003,557	39,174,914	32,531,119	11,999,643	
Capital on which loans are not given,						
New York 4,394,000						
Delaware 830,000						
		5,224,000				
Capital on which loans are given,		89,779,557				129,815,441

The most important banking establishment in the United States is the Bank of the United States, an institution incorporated for twenty years by Congress, in the year 1816.† The situation, and the general movements of that institution, were fully detailed in the report of the president of the bank to the meeting of the stockholders, 1st September 1831, the greater part of which we here insert.

"The capital of the bank consists of 350,000 shares, of which 70,000 are owned by the government of the United States. The government originally provided for its subscription by giving to the bank a stock bearing interest at five per cent. This stock has been for some time in a course of redemption, and in July last the whole of it was reimbursed, so that the government has now fully paid for its shares. This capital is divided among the stockholders as follows:

Distribution, July 1831.

	Names.	*Shares.*
Maine,	14	498
Vermont,	2	27
New Hampshire,	23	501
Massachusetts,	208	10,812
Rhode Island,	38	1,245
Connecticut,	61	1,511
New York,	439	32,903
New Jersey,	77	2,665
Pennsylvania,	937	52,638
Delaware,	39	1,583
Maryland,	623	34,503
District of Columbia,	63	2,814
Virginia,	276	12,384
North Carolina,	39	2,476
South Carolina,	735	40,674
Georgia,	42	1,981
Ohio,	15	705
Kentucky,	22	252
Tennessee,	4	238
Indiana,	2	50
Illinois,	2	220
Louisiana,	17	119
Arkansas Territory,	1	42
Foreign Stockholders,	466	79,159
United States,		70,000
	4,145	350,000

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* The legislature of Pennsylvania, at their session in April 1832, incorporated six additional banks, with an aggregate capital of about 2,750,000 dollars —Ed.

† An act to modify and continue the charter of the Bank of the United States till the 3d of March 1851, passed the senate by a majority of eight votes, and the house of representatives by a majority of twenty-two votes. It was presented to the president for his approbation on the 4th of July 1832, and on the 10th was returned by him to the senate with his veto.—Ed.

The capital thus owned is divided for the purposes of business between the bank and the following twenty-five offices:

Portland,
Portsmouth,
Boston,
Providence,
Hartford,
Burlington,
New York,
Utica,
Buffalo,
Baltimore,
Washington,
Richmond,
Norfolk,
Fayetteville,
Charleston,
Savannah,
Mobile,
Natchez,
New Orleans,
St. Louis,
Nashville,
Louisville,
Lexington,
Cincinnati,
Pittsburgh.

"The number of offices established in 1817 was eighteen; since then two offices have been discontinued—Middletown in Connecticut, and Chillicothe in Ohio, and nine others have been established. Portland in Maine; Burlington in Vermont; Hartford in Connecticut; Utica and Buffalo in New York; St. Louis in Missouri; Nashville in Tennessee; Natchez in Mississippi; Mobile in Alabama; making an addition of seven offices within the last fourteen years. These points were selected out of applications from thirty-eight places. There are now under consideration applications for the establishment of branches from more than thirty places in various parts of the United States.

"The employment of the capital will be seen in the following statement of the condition of the bank on the 1st of August.

DR.

Funded debt, various,			3,497,681 06
Bills discounted on personal security,	41,585,298 70		
Fund. dt.	19,700 00		
" Bk. stk.	779,458 07		
		42,384,456 77	
Domestic bills of exchange,		14,409,479 72	
			56,793,936 49
Foreign bills of exchange,			121,214 60
Real estate,			2,491,892 99
Due from Bank U. States and offices,		24,586,664 94	
Due from State Banks,		2,903,402 51	
			27,490,067 45
Due from United States,			5,267 32
Deficiencies,			145,258 67
Banking houses,			1,160,455 54
Expenses,			68,713 34
Cash, viz. notes of Bank U. S. and offices,		13,412,176 44	
Cash, viz. notes of the State Banks,		2,080,442 33	
Cash, viz. specie,		11,545,116 51	
			27,037,735 28
Mortgages,			140,956 63
Navy agent, Norfolk,			40,144 17
			118,993,323 54

CR.

Capital stock,		35,000,000 00
Notes issued,		35,811,623 96
Discount, exchange and interest,		476,965 51
Foreign exchange account,		137,719 56
Baring, Brothers and Co., Hottinguer and Co., and Hope and Co.		168,372 72
Dividends unclaimed,		251,766 03
Profit and loss,		1,750,048 51
Contingent fund,	5,613,173 15	
Less losses chargeable to contingent fund,	3,452,976 16	
		2,160,196 99
Due to Bank U. States, and offices,	24,096,888 37	
Due to State Banks,	2,771,656 00	
		26,868,544 37
Redemption of public debt,		483,147 46
Deposits on account of the Treasurer of the United States,	5,505,924 28	
Less overdrafts and special deposits,	28,420 09	
	5,477,504 19	
Of public offices,	1,291,597 77	
Individuals,	9,115,836 47	
		15,884,938 43
		118,993,323 54

The analysis of this account presents the following view of the investments of the bank, and the distribution of its funds.

The Investments of the Bank.—

Capital paid in,		35,000,000 00
The circulation,		22,399,447 52
Deposits, public,	7,252,249 42	
private,	9,115,836 47	
		16,368,085 89
Due to individuals in Europe,		168,372 72
Unclaimed dividends,		251,766 03
Contingent fund to meet losses,		5,613,173 15
Discount, exchange and interest (including foreign exchanges),		614,685 07
Profit and loss,		1,750,048 51
		82,165,678 89

Distribution.

Funded debt,		3,497,681 06
Loans.		
Personal security,	41,585,298 70	
Funded debt,	19,700 00	
Domestic bills,	14,409,479 72	
Foreign do.	121,214 60	
Bank stock,	779,458 07	
Mortgages,	140,956 63	
Debts chargeable to contingent fund	3,452,976 16	
		60,509,083 88

Real estate,	2,491,892	99
Due from sundry offices and banks	621,523	08
Expenses, &c.	259.383	50
Banking houses	1,160,455	54
Notes of state banks,	2,080.442	33
Specie,	11,545,116	51
	82,165,578	89

"The bank of the United States was established for the purpose of restoring specie payments, which had for a long time been suspended throughout a great part of the country,—of furnishing a sound circulating medium, and of giving more uniformity to the exchanges between distant sections of the union. By importing more than seven millions of specie, and by a free issue of notes immediately after its establishment, the bank with great sacrifices succeeded for a time in attaining these objects; but it seems to have been afterwards considered that its powers were exhausted by the effort, and that the continuance of it would be entirely impracticable. The essential difficulty was presumed to lie in the provision of the charter, making the notes universally receivable for debts to the government, which by obliging the bank to provide payment for the same note at various places, would require it to retain a greater amount of specie than it could issue of notes; thus diminishing rather than increasing the sound circulation. The consequence was, that the bank issued its own notes sparingly; more especially in the southern and western states, where it often preferred the re-issue of the notes of the state banks; being unwilling to issue freely its notes which it might be compelled to pay at some one of many places remote from the point of issuing them. However imperious the necessity which enforced this system, it was apparent that its continuance would tend to defeat the object of establishing the bank, since by declining the issue of its notes it could not furnish the circulating medium expected from it; and by reissuing the notes of state banks, it surrendered its most efficient means of control over the currency. Its whole circulation on the 1st of January 1823 was only $4,589,000.

"Having, in compliance with the directions of the stockholders in 1822, applied without success to Congress for a modification of this disabling provision in the charter, it became necessary for the board of directors to re-examine the constitution of the bank, in order to discover whether there was really any organic defect which prevented it from performing the functions to which it was destined, or whether some different combination of its powers might not overcome its difficulties.

"The experiment was interesting and hazardous. It was to try how far the institution could succeed in doing that which had never yet succeeded elsewhere, in diffusing over so wide a surface of country a currency of large amount and of uniform value at all places and under all circumstances; and also whether it could bring down to its extreme limit the necessary expense of commercial intercourse between distant sections of country, whose exchangeable productions were of such various and unequal values.

"To accomplish these two objects two things seemed necessary.

"1st. To make all the local currencies equivalent to specie at the place of their emission. This, by rendering them competent for local purposes, would require a less amount of general currency, and at the same time tend to reduce the exchanges between distant places to the real commercial expense of transferring equal values of coin.

"2d. To make the bank itself the great channel of those commercial exchanges.

"If the bank is bound to transfer the whole public revenue throughout the union, and to furnish a currency payable in various and distant places, it must obviously provide funds in those places, and these can of course be obtained only by purchasing bills of exchange payable at the points to which the course of trade naturally directs the notes. There these bills, having reached their maturity, await the coming of that portion of the notes, which having performed for a time the functions of a circulating medium, are carried by the demand for duties out of the immediate sphere of their issue. The greater proportion of its funds, therefore, which the bank can employ in these operations, the more readily can it sustain the notes issued in the course of them. It is indeed thus, and thus alone, that a circle of sound banking operations founded on sound commercial operations contains within itself the means of its own defence at home, and of providing for its notes which the demand for duties may carry to a distance. These operations too are fortunately of the highest benefit to the community; they give the most direct encouragement to industry, by facilitating the purchase and interchange of all its products, they bring the producers and consumers into more immediate contact by diminishing the obstacles which separate them, and they specially adapt the bank to the wants and interests of each section of the union, by making it alternately a large purchaser among the sellers of bills, and a large seller among the purchasers.

"A participation also in the foreign exchanges forms an essential part of the system, not merely as auxiliary to the transfer of funds by which the circulating medium is accompanied and protected, but as the best defence of that currency from external influences. It is the peculiarity of our moneyed system, that in many parts of the country the precious metals are excluded from the minor channels of circulation by a small paper currency, in consequence of which the greater portion of these metals is accumulated in masses at the points of most convenient exportation. Now with a widely diffused metallic currency, the occasional demands for exportation are more gradually felt, the portion exported bearing a small relation to the whole, occasions less inconvenience, and the excesses of exportation can be more readily corrected without injury. But when the great mass of the precious metals of the community lie thus accessible in the banks of the Atlantic cities, liable to be immediately demanded on notes previously issued in the confidence of a continuance of the same state of things which caused the abundant issue of them; at the first turn in the tide of the foreign exchanges---when the supply of foreign exchange is unequal to the daily demand, the vaults of the banks may be exhausted before any precautions can prevent it. These very precautions, too, consisting as they do almost exclusively of curtailments in their loans, made suddenly---mostly without concert, and always under the influence of anxiety if not alarm, may fall with oppressive weight on the community, by the pressure on which alone can be produced the necessary re-action. This re-action moreover is necessarily slow, since our distance from Europe makes it less easy to restore the equilibrium than between adjoining countries in the same hemisphere. As this defect in our moneyed system depends on the legislature, the bank has no power to remove it, and can only strive to guard against its dangers. Its tendency is to produce abrupt transitions, and violent shocks injurious to private credit, and which might prove subversive of the currency. It belongs then to the conservative power over the circulating medium which devolves on the bank, not to be a passive observer of these movements, but to take an ample share in all that concerns the foreign exchanges. It may thus foresee, and either avert or diminish an approaching danger—it can thus break the force of a sudden shock, and supplying from its own accumulations or its own credits in Europe the more pressing demands, enable the state institutions to provide for their own safety, and thus produce the necessary alteration in the state of the exchanges with the least possible pressure upon the banks or the community.

"In addition to the ordinary causes of fluctuation in the metallic currency, there was another of great importance in the character of the trade to China and India, which, requiring annually many millions of the precious metals, very frequently caused abrupt and inconvenient changes in the amount of the currency and of private credit, by forcing the state banks to sudden curtailments as an act of necessary self-defence. To abate the pressure of this demand, the bank offered as a substitute for the shipments of coin, to supply its own bills on Europe, which in the India and China markets were often more valuable than the coin itself. This experiment proved successful, alike to the merchants and to the community, who were thus less incommoded by sudden diminutions of the currency. Owing to the operation of general causes, that trade has within a few years greatly declined,—but should it revive, the bills of the bank will doubtless constitute a considerable portion of the remittances from this country. Even in its present comparatively inactive state, the amount of bills furnished by the bank within the past year for the trade of India, China and South America, amounts to $883,500.

"By this combination of the soundness of the local currencies, and a thorough identification of the bank with the real business and exchanges of the country, it was hoped to accomplish the purposes for which it was established. With this view it began by giving to its whole funds an active and business character, for which purpose all the stock of the bank which had been forfeited was sold, and the proceeds applied to the commercial operations of the country. The bank and the branches then issued freely and exclusively their own notes, taking care to protect and provide for them by the discount of bills of exchange---and they received freely the notes of the solvent state banks, with whom periodical and convenient but certain settlements of accounts were made.

"This system has now been in operation for several years. It was at first experimental and of doubtful issue, and as the consequences were equally important to the bank and the community, its progress has been watched with deep solicitude. Its success, therefore, has been seen with proportionate satisfaction. Time and experience have now demonstrated that the bank has been able to accomplish all the purposes for which it was created, to rectify the disorders of the currency, to sustain a large and sound circulation, and to reduce the commercial exchanges within the most economical limits, and this by means in themselves highly advantageous to the community, not in any degree injurious to the state institutions, and at the same time profitable to the bank itself. The evidences of this can be best observed by comparing the past and present situation of the currency, the exchanges, the country and the bank.

"1. Before the establishment of the bank, the cirlating medium of the middle, western and southern states consisted exclusively of an inconvertible paper money; every part of that country suffered under the most oppressive of all taxes on industry, a depreciated currency; the commercial exchanges between different states and even different neighbourhoods, were burdened with the fluctuations of their respective representatives of money, while the government itself, unable to make its funds received in one section available for its expenditures in another, was embarrassed in the midst of its nominal excesses of revenue. These disorders are now remedied. The local currencies generally are equivalent to specie within their respective spheres of circulation, and a large mass of general currency is superadded for general circulation. That this effect was produced directly by the operations of the bank requires no demonstration. The extent of its contribution to the general currency, will be seen in the facts..

"1st, That since January 1, 1823, it has furnished to the mint, to be converted into American coin, bullion to the amount of - - $12,046,415 35

"2d, That the gross circulation of the bank on the 1st of January 1823, was - - - - - 4,589,446 90
And on the 1st of August 1831, 22,399,447 52
Making an increase of - 17,810,000 62

"From both periods a deduction is to be made of the notes in their passage between the bank and the branches. The total amount known to be in actual circulation on the 1st of August was $19,377,910.

"This circulation is in all respects equal, and in most respects superior, in value, to any metallic currency of the same amount. Indeed there is not now, and probably never has been, in any other extensive country, a paper currency comparable to this for the union of all the qualities of a good circulating medium—perfect security—easy convertibility into the metals—and general uniformity of value.

"The notes of the bank, moreover, not only afford a sound currency themselves, but they sustain and purify the much larger mass of circulating medium into which they are infused. By receiving freely the notes of the state banks within convenient reach of the bank and its branches, and by frequent settlements with them, these institutions are kept in the habitual presence of an accountability, which naturally induces them so to apportion their issues to their means, as to secure the soundness of their currency. Of the manner in which they have executed this extremely delicate part of their duty, which connects them with the state institutions, it is not for the board of directors to speak. But they bear a willing testimony in favour of the uprightness and intelligence which generally characterize the administration of those institutions, and the support which they have always yielded to any measures calculated to maintain the soundness of the currency.

"On the few occasions where it has become necessary to insist on the performance of their obligations, from which either a want of judgment, or the pressure of urgent necessity had induced them to depart, the bank has endeavoured to perform its own duty with all the forbearance consistent with the thorough execution of it, and those institutions themselves, have generally found in the increased credit arising from fidelity to their engagements, a full compensation for all the temporary inconvenience which that fidelity required. It is indeed confidently believed that the solvent state institutions, recognize in the bank its true character, as a common friend, not a jealous competitor; and that the good feelings uniformly entertained for them by the bank, are reciprocated. They know that the duties of its position make it only a more prominent agent in preserving the soundness of the currency, on which their own stability and prosperity equally depend; and that if its competition sometimes appears to prevent more abundant profits, they find an indemnity in the general security of property which its operations are designed to protect. Undoubtedly these operations have been so far beneficial to them, that if its own notes are equivalent to specie, it has contributed to make those of the state institutions equally valuable within their respective spheres, and that many of these institutions earn larger profits than the bank itself.

"2d. The reduction in the exchanges effected by the bank from the extravagant charges on internal trade to the present moderate limits need not now be particularized. A single fact will be sufficient to illustrate it. Before the bank was organized the differences of exchange in favour or against Philadelphia, in its relations with the other commercial cities, was as follows.

"With Boston, 17 per cent; with New York, 9½ per cent; with Baltimore, 4½ per cent; with Washington, 7 per cent; with Charleston, 6½ per cent.

"At present these exchanges are generally, either at par, or at the utmost, one half of one per cent.

"This has naturally followed the rectification of the currency. As long as the general circulation of the United States consists of specie or its equivalents, the rates of exchange between any two places in it can never much, nor permanently vary from the expense of their transportation from one place to another; and a reduction to nearly that rate was the inevitable consequence of the resumption of specie payments. The bank has, however, been able to do more than this. The large mass of its operations in exchanges, by giving to it funds in various parts of the union which the course of its own business, as well as that of the government, requires to be transferred, furnishes it with the means of transferring at the same time the property of individuals at a very reduced expense. Accordingly funds are transferred to the remotest points of the union, sometimes at no expense whatever, and always with charges so moderate, as to afford facilities of interior communication, probably not equalled by those of any other country.

"The following table exhibits the amount of domestic and foreign exchange purchased at the bank, and the several branches, the amount of the drafts furnished by them on each other respectively, and the amount of transfers made on account of the government, during the year ending on the 1st of July last.

TABLE LXIV.

Statement exhibiting the Exchange operations of the Bank of the United States and Offices, for the year ending June 30, 1831.

	Bills Purchased.	Drafts Drawn.	Transfers directed by the U. States from the Bank and Offices.	TOTALS.
Foreign,	3,481,963 75	8,699,744 16		
Domestic,	4,122,394 79	5,110,570 22		
Bank United States,	7,604,358 54	13,810,314 38	650,000 00	22,064,672 92
Office Portland,	136,746 89	194,275 04	200,000 00	531,021 93
" Portsmouth,	47,713 38	77,431 50	15,000 00	140,144 88
" Boston,	1,499,531 18	1,077,297 33	1,575,000 00	4,151,828 51
" Providence,	966,590 76	745,063 16		1,711,653 92

TABLE LXIV. continued.

	Bills purchased.	Drafts Drawn.	Transfers directed by the U. States from the Bank and Offices.	TOTALS.
Office Hartford,	114,360 44	325,685 97		440,046 41
" New York,	3,790,432 10	1,512,347 41	8,175,000 00	13,477,779 51
" Baltimore,	963,298 09	2,006,200 48	580,000 00	3,549,498 57
" Washington,	722,725 41	3,503,391 35		4,226,116 76
" Richmond,	1,514,295 35	343,595 72		1,857,891 07
" Norfolk,	706,017 58	1,368,380 00		2,074,397 18
" Fayetteville,	929,453 10	572,517 06		1,501,970 16
" Charleston,	1,960,488 48	1,637,684 12	85,000 00	3,683,172 60
" Savannah,	2,099,844 29	770,210 49	75,000 00	2,945,054 78
" Mobile,	1,599,022 90	2,615,265 13		4,214,288 03
" New Orleans,	9,363,195 66	2,825,187 18	825,000 00	13,503,382 84
" Natchez,	424,108 57	363,444 71	20,000 00	807,553 28
" St. Louis,	244,334 24	562,993 00	150,000 00	957,327 24
" Nashville,	2,693,852 75	1,091,667 19		3,785,519 94
" Louisville,	1,924,571 49	1,291,355 05	100,000 00	3,315,926 54
" Lexington,	1,495,631 61	1,493,810 45	10,000 00	2,999,442 06
" Cincinnati,	1,212,729 71	1,102,964 67		2,315,694 38
" Pittsburgh,	989,834 33	1,077,028 10		2,066,862 43
" Buffalo,	714,218 17	1,558,202 26		2,272,420 43
" Utica,	118,041 25	133,778 29		251,819 54
" Burlington,	218,123 85	63,071 19		281,195 04
	44,053,520 10	42,123,161 23	12,460,000 00	98,636,681 35

" From this it will appear, that the purchases of bills of exchange amount to more than forty-four millions, the drafts issued by the bank and the branches on each other exceed forty-two millions; and the transfers on account of the government were upwards of twelve millions. If to these be added the amount of bills not purchased in the first instance by the bank, but collected through its agency, the aggregate will represent an actual movement in the business of the union, much exceeding one hundred millions of dollars. This has been conducted at a very moderate expense, and with a facility which has caused so large a displacement of funds, to be almost imperceptible in any of the interests of the community. More experience and a greater mass of operations may enable the bank to reduce still further, even these slight charges; but should it be able only to retain them at their present rates, it will have accomplished all that is necessary or perhaps desirable.

" 3d. The influence of these measures on the country has been in every stage of them eminently salutary. The substitution of a sound currency for a depreciated and irresponsible circulation, which was hastening to involve in confusion, all public and private interests, is of itself an advantage, which can scarcely be over-estimated, conferring, as it does, stability on property, and security on all the rewards of industry; while the interior commerce of the whole union is relieved from the oppressions of a multifarious and fluctuating paper money, requiring at each step some new sacrifice which, however disguised, fell ultimately as a charge on the productive industry of the country. The means, moreover, by which these objects have been attained, the restraint on the over issues of other institutions—the extensive operations in domestic and foreign exchange—the bringing of the institution into immediate contact and sympathy with the real business of all parts of the country, are in themselves direct and positive benefits to the community. They form too the natural occupation of a *Bank of the United States*, which, divested of all local influences and interests, finds its appropriate sphere in facilitating the commerce of the states with each other and with foreign nations. Accordingly, it may be assumed with safety, that there has never been in the history of this country, any period when its moneyed concerns were more steady and equal—its interior trade transacted with more economy and convenience, and the necessary fluctuations incident to its foreign commerce less sensibly felt, than during the last eight years. This term is sufficiently long and various to test the efficacy of the system. It embraced a period, when, in addition to its habitual causes of fluctuation the moneyed system was disturbed by the reimbursement of many millions of the public debt, a great portion of which was to be remitted to Europe, and more especially it included the year 1825, one of the most critical in our own history, and probably the most disastrous to the banking system of England.

" 4th. Having explained the effects of this system on the currency, the exchanges, the state banks, and the community, it remains to show that these purposes have been accomplished without any sacrifice to the interests of the stockholders, but that the bank itself has shared in the benefits it communicates. This will be perceived by contrasting the present state of the institution, with its condition at the triennial meeting of 1822. Its situation at these respective periods was as follows:

State of the Bank, August 30, 1822.

Capital paid in, - -		$34,992,139 63
The circulation, -		5,456,891 90
Deposits.—Public,	3,559,792 96	
Private,	3,216,699 78	
		6,776,492 74
Due to sundry offices and banks, and to individuals in Europe,		1,964,898 36
Unclaimed dividends, -		129,741 28
Contingent fund to meet losses,		3,743,899 00
Discount, exchange, and interest, since July, - - -		388,237 01
Profit and loss, - -		51,897 07
		$53,504,196 99

DISTRIBUTION.

Funded debt, - -		13,020,469 27
Loans, viz.		
Personal security,	22,072,405 46	
Funded debt,	67,928 13	
Domestic bills,	2,713,760 30	
Debt of Smith & B.	1,357,457 23	
Foreign bills,	24,599 76	
Bank stock,	5,974,725 80	
Mortgages,	8,000 00	
		32,218,876 68
Due by banks, &c. - -		1,650,869 73
Real estate, - -		587,102 38
Bonus, premium, &c. - -		1,180,880 00
Banking houses, - -		834,922 15
Notes of state banks, - -		664,642 56
Specie, - - - -		3,346,434 22
		$53,504,196 99

State of the Bank, August 1, 1831.

Capital paid in, - - -		$35,000,000 00
The circulation, - - -		22,399,447 52
Deposits.—Public,	7,252,249 42	
Private,	9,115,836 47	
		16,368,085 89
Due to individuals in Europe, -		168,372 72
Unclaimed dividends, -		251,766 03
Contingent fund to meet losses, -		5,613,173 15
Discount, exchange and interest (including foreign exchange), -		614,685 07
Profit and loss, - -		1,750,048 51
		$82,165,578 89

DISTRIBUTION.

Funded debt, - - -		3,497,681 06
Loans:		
Personal security,	41,585,298 70	
Funded debt,	19,700 00	
Domestic bills,	14,409,479 72	
Foreign do.	121,214 60	
Bank stock,	779,458 07	
Mortgages,	140,956 63	
Bills chargeable to contingent fund	3,452,976 16	
		60,509,083 88
Real estate, - - -		2,491,892 99
Due from sundry offices and banks,		621,523 08
Expenses, &c. - - -		259,383 50
Banking-houses, - -		1,160,455 54
Notes of state banks, -		2,080,442 33
Specie, - - - -		11,545,116 51
		$82,165,578 89

"The analysis of these statements will present the following differences in the situation of the bank at these respective periods:

"1st. In regard to the comparative activity of its business:

In August 1822, of the whole amount of loans amounting to -	$32,218,876 68
There was suspended - -	10,426,306 56
Leaving as active, - -	21,792,570 12
In August 1831, of the same class of loans amounting to -	56,793,986 49
There was suspended - -	3,633,750 84
Leaving as active, - -	53,160,235 65
In August 1822, of the loans of	32,218,876 68
There were on bank stock, -	5,974,725 80
In August 1831, out of the loans of	56,793,936 49
There were on bank stock, -	779,458 07

In regard to the exchanges:

The amount of domestic bills purchased in 1822, was -	7,475,640 00
That purchased within the year ending July 1, 1831, was -	40,571,556 35

"2d. In regard to its resources and investments, there will be seen,

"1st. That the bonus and premium on the loan of 1821, amounting then to $1,180,880 00 has been extinguished.

"2d. That there is an increase of the contingent fund to repair losses, of - $1,869,274 15 Making that fund exceed by $309,000, the loss it is to cover.

"3d. An increase of the surplus fund, of - - - - - - $1,698,102 93

"4th. An increase of the capital, of 7,860 37

"5th. An increase of the circulation, of - - - - - 16,942,555 62

"6th. An increase of the deposits, of 9,591,493 15

"7th. An increase of the investments as follows:

Loans,	$28,290,207 20
Real estate,	1,904,790 61
In banking houses,	325,533 39
In state bank and other debts,	3,052,579 34
In specie,	8,198,682 29
	$41,771,792 83
And a decrease of the funded debt, of	9,522,788 21
Making the actual increase	$32,249,004 62

"The 3d and last consideration is the comparative productiveness of the operations of the bank at these periods:

The nett profits of the year ending July 1822, were,	$1,469,444 91
The nett profits of the year ending July 1831, were,	2,935,021 19
Making an increase of	1,465,576 28

"This state of things is calculated to justify the expectation, that a continuance of the same prosperity will at length indemnify the stockholders for the privations of profit to which they have been so long subjected. Hitherto their compensation has been comparatively inadequate. Owing to the large expenses incident to the establishment of the bank, and to the great losses growing out of its early misfortunes, the whole amount of dividend, from January 1817 to July 1831, a period of fourteen years and a half, has been only $72.85, or a small fraction beyond five per cent a year, on the original subscriptions of one hundred dollars. The dividend during the last three years and a half, has amounted to seven per cent a year; and it would require a continuance of the same dividend for eleven years and a half more to make the annual dividend, from the establishment of the bank, equal to six per cent a year.

"If, however, the stockholders have been less benefitted by their investment than was anticipated, they may derive consolation for their diminished profits, in the general prosperity of the country at large, to which the operations of the bank have contributed.

"It is, indeed, the main design of presenting these details, to show the practicability of continuing these advantages without a sacrifice of the personal interests of the stockholders. The experiment, for such it undoubtedly was, of sustaining a large and sound and uniform currency, and of reducing the exchanges of the country to the most economical limits, has been fairly and fully made upon systematic principles. It has now for many years succeeded, and it may be presumed that the same efforts will continue to produce similar results. But in any event, the Board of Directors have the satisfaction of knowing that their exertions have thus far rendered the bank not unproductive of benefit to the country; and that if any unforeseen causes should hereafter prevent or diminish the beneficial operations of the institution, it shall not fail from any want of zealous devotion to the great interests which they have been appointed to administer."

THE POST OFFICE.

On the 1st of July 1831, there were in the United States, 8686 post-offices: and the post-roads were in extent about 116,000 miles.

The annual transportation of the mail was, as stated by the postmaster-general:

In stages and steam-boats,	10,728,348
On horseback and in sulkies,	4,740,344
Making the whole annual transportation equal to	15,468,692 miles.

From the 1st of July 1830 to the 1st of July 1831, the increase of the transportation of the mail was,

In stages, equal to	834,450
On horseback and in sulkies,	134,252
Making an increase within the year equal to	968,702 miles.

Such is the present state of the post-office establishment of the United States, and at this rate is it annually extending its operations. Between all the most important places in the country there are daily mails, which perform their journeys at the rate of six to ten miles an hour. To the second and third rate towns, not lying in the main routes, mails go twice or thrice a week: and there are few villages of any size which are not visited by the mail at least once a week.

The advantages of this system are felt by every man who can read and write: but we cannot properly appreciate them, without considering the origin of the post-office establishment in other countries, and its progress in our own. Nothing more clearly than the letter-mail marks the difference in the character of ancient and modern times.

Philip de Comines dates the establishment of regular posts in 1462, and ascribes their origin to Louis XI. of France. Other authors contend that they were in use in the reign of Charlemagne, and afterwards discontinued. Be this as it may, the posts established by Louis XI. were only for the use of the court: for the author of the life of the Duke d'Espernon says, that the packet or letter office was not set up in France in the year 1619.

As establishments for the use of government, posts are of a far more ancient date than the time of either Louis XI. or of Charlemagne. Herodotus ascribes their origin to Cyrus. Augustus introduced them among the Romans; and they are mentioned in the code of Theodosius. But they were employed only to forward the public dispatches, or to convey political intelligence.

It is surprising that they were not sooner used for the purposes of commerce and of private communication. It is, at most, but about 200 years since the public posts were made to afford any great facilities to individuals. In Camden's Annals, we read that Mr. Thomas Randolph, who was often employed by Queen Elizabeth in affairs relating to Scotland, was, in 1581, in the office of chief postmaster of England: but in what manner the office was instituted does not clearly appear. Charles I. certainly regarded it as a source of emolument: for in the nineteenth volume of the Fœdera, there is a grant to William Frizell, and others, of the office of postmaster for foreign parts in reversion: and in 1631 the king strictly prohibited private persons from engaging in the business of forwarding letters to foreign countries, or receiving them from abroad for distribution in England.

In 1635, the king issued a proclamation declaring that " whereas to this time there has been no certain intercourse between the kingdoms of England and Scotland, he now commands his postmaster of England for foreign parts, to settle a running post or two to run night and day, between Edinburgh and London, to go thither and come back again in six days: and to take with them all such letters as shall be directed to any post-towns in or near the road." By the same proclamation, posts were established to Westchester, Holyhead, and thence to Ireland: and also to Plymouth and Exeter.

In the following year, Charles the first of England and Louis the thirteenth of France, both issued proclamations forbidding private persons from engaging in the business of letter carrying: but the operations of the public posts must, notwithstanding, have been very limited, for in 1653, the whole establishment in England, Scotland, and Ireland, was farmed to John Manly, Esq. for ten thousand pounds yearly. At that time, members of parliament had not the privilege of franking letters.

In 1656, Cromwell and his parliament established the post-office by law: the acts of this parliament being deemed illegal by the royalists, another act to the same effect was passed in 1660—61, after the restoration. In 1663, the revenues of the post-office, amounting to 21,500*l.* were settled on the Duke of York. In 1685, the obsequious parliament of James II. passed an act to make the revenue of the post-office the king of England's private estate for ever. In 1711, the former laws for establishing post-offices in Great Britain were repealed, and one postmaster-general was appointed for the kingdom. By the same act, general letter offices were established at Edinburgh, Dublin, *New York*, and in the West Indies.

This is the first reference we find in British acts to post-offices in America: but the establishment of posts in our country was nearly coeval with the first settlement of at least some of the colonies. In July 1683, as we learn from Watson's Annals, William Penn established regular posts from Philadelphia to the Falls of Delaware, Chester, Newcastle, and Maryland; and ordered the time of departure to be carefully published " on the meeting-house door, and other public places." A regular act of assembly, for the establishment of a post-office at Philadelphia, was first passed in the year 1700.

Soon after this, Colonel John Hamilton, the son of Governor Andrew Hamilton, devised a post-office scheme for British America. For this scheme he obtained a patent, and the profits accruing from the execution of the scheme were to be his own. But he afterwards sold his patent to the crown: and a member of parliament was appointed postmaster for North America, with power to appoint a deputy to reside at New York. By connivance, as is stated by Dr. Douglass, the deputy was permitted to reside in any part of the continent. The office was filled at one time by a gentleman of South Carolina; and, at another, by a gentleman of Virginia.

In Dec. 1717, Jonathan Dickinson writes to his correspondent, " we have a settled post from Virginia and Maryland unto us, and goes through all our northern colonies, whereby advice from Boston unto Williamsburgh is completed in four weeks, from March to December, and in double that time in the other months of the year."

Dr. Douglass, writing in 1747, says, " that from Portsmouth to Philadelphia there is a regular postage. From thence to Williamsburgh, in Virginia, is uncertain, because the post does not proceed till letters are lodged sufficient to pay the charges of the post-rider. From Williamsburgh, in Virginia, to Charleston, S. C., the post is still more uncertain."

In 1753, the post-office establishment of North America was confided to Dr. Franklin and another, with liberty to make out of it 600*l.* a year, " if they could." Then began the delivery of letters by the penny-post, and also the practice of advertising letters remaining in the office.

Till that time, the northern mail went from Philadelphia and returned once a week in summer, and once a fortnight in winter, just as it had done twenty-five years before. But in 1754, the mail to New York began to run thrice a week in summer, and once a week in winter. In the next year Franklin gave notice, that the mail to New England, which used to start but once a fortnight in winter, should start once a week all the year round, " whereby answers might be obtained to letters between Philadelphia and Boston in three weeks, which used to require six weeks."

It was several years before Dr. Franklin and his co-partner got the 600*l.* per annum, which they were permitted to make for themselves, " if they could." Their expenditures for the improvement of the mail brought them in debt to the amount of 900*l.*: but the doctor states, that under this new system, the post-office of North America afterwards yielded a greater clear revenue to the crown than had ever been derived from the post-office of Ireland. Through a quarrel with the ministry he was deprived of his office of deputy, at a time when it would have yielded him a just compensation for his labour.

In 1774, we read that " John Perkins engages to ride post to carry the mail once a week to Baltimore, and will take along, or bring back, led horses, or any parcels." From this it appears that, previous to the revolution, only the northern mail was regular in its arrival and departure. When a post-rider purposed starting to the south, notice was given of his intention by advertisement, some time in advance.

On the 26th of July 1775, congress established a line of posts, under the direction of a postmaster-general, from Falmouth in New England to Savannah in Georgia; and they authorised as many cross posts as that officer should think proper. In

1782, all the surplus income of the post-office was directed to be applied to the establishment of new post-offices and the support of packets, to render the post-office department as extensively useful as might be. In 1789, authority was given, under the new constitution, to appoint a postmaster-general and other subordinate officers. The progress of the department, from that time to the end of the year 1830, may be seen in the table at the end of this article. From 1790 to 1800, the number of post-offices increased from 75 to 903. In 1810, they amounted to 2300: in 1820, to 4500: in 1830, to 8450.

"The great increase of the number, and the extent of the post-roads in the United States," said Dr. Seybert, writing in 1817, "demonstrate the rapid improvement of our country. Besides the convenience which this establishment offers to individuals, much of the commercial prosperity of nations is owing to the dispatch and safety of a well regulated post-office establishment. In this respect, our progress has been equal to that of any of the nations of Europe: convenient roads now intersect every portion of the United States. Though we do not possess many routes that are equal to the most improved in England and France, our roads are more safe, more expeditious, and better regulated than those of any other nation in Europe. Even so late as 1750, the roads in Great Britain and France were in a wretched condition: they have done much within a few years to promote the intercourse in those states. In 1763, seventeen days were occupied in going from London to Edinburgh, in the stage-coach, the distance about four hundred miles. In 1816 you might go from the city of New York to Buffalo on lake Erie, four hundred and seventy-five miles, in one hundred hours from the time of departure, and be comfortably lodged every night: the time actually occupied in travelling was eighty hours. Our mail is now transported with uncommon rapidity through countries which continue to be inhabited by savages: our vehicles pass with more speed to towns, the sites of which twenty-five years ago were the theatres of savage barbarity, than do the public carriages in some of the most civilized and oldest countries in Europe. You may go from Philadelphia to Pittsburgh, in the stage, three hundred and ten miles, in five days and a half, and be lodged every night on the route.

"In 1812, in France, by the stage-coach, six days were required to go from Paris to Geneva, three hundred and ninety miles: six days from Paris to Strasburgh, three hundred and sixty-six miles."

The mail now goes from Philadelphia to Pittsburgh in less than three days, traversing in this passage all the mountain chains of Pennsylvania.

[The annexed table, obtained from the Post-Office Department, exhibits a concise view of the rapid increase in the post establishment of the United States from 1789 to Dec. 31, 1830.]

TABLE LXV.

Table of the Post Office Establishment, from 1789 *to* 1830, *December* 31*st.*

Years.	Post Offices in number.	RECEIPTS, being total am't of postage.	EXPENDITURES.				Bal. in favour of Department.	Balance against Department.	Extent of post roads in miles.
			Compensation to P M.	Incidental expenses.	Transportation of Mail.	Total Expenditures.			
1789	75								
1790	75	$37,935	$ 8,198	$1,861	$22,081	$32,140	$5,795		1,875
1791	89	46,294	10,312	3,092	23,293	36,697	9,597		1,905
1792	195	67,444	16,518	5,282	32,731	54,531	12,913		5,642
1793	209	104,747	21,646	5,660	44,734	72,040	32,707		5,642
1794	450	128,947	27,156	9,812	53,005	89,973	38,974		11,984
1795	453	160,620	30,272	12.262	75,359	117,893	42,727		13,207
1796	468	195,067	35,730	14,353	81,489	131,572	63,495		13,207
1797	554	213,998	47,109	13,623	89,382	150,114	63,884		16,180
1798	639	232,977	56,035	16,035	107,014	179,084	53,893		16,180
1799	677	264,846	63,958	14,605	109,475	188,038	76,808		16,180
1800	903	280.804	69,243	16,107	128,644	213,994	66,810		20,817
1801	1025	320,443	79,338	23,363	152,450	255,151	65,292		22,309
1802	1114	327,045	85,587	21,658	174,671	281,916	45,129		25,315
1803	1258	351,823	93,170	24,084	205,110	322,364	29,459		25,315
1804	1405	389,450	107,716	24,231	205,555	337,502	51,948		29,556
1805	1558	421,373	111,552	26,180	239,635	377,367	44,006		31,076
1806	1710	446,106	119,785	25,895	267,893	413,573	32,533		33,431
1807	1848	478,763	129,041	32,093	292,751	453,885	24,878		33,755
1808	1944	460,564	128,653	28,676	305,499	462,828		2,264	34,035
1809	2012	506,634	141,579	23,516	332,917	498,012	8,622		34,035
1810	2300	551,684	149,438	18,565	327,966	495,969	55,715		36,406
1811	2403	587,247	159,244	20,689	319,166	499,099	88,148		36,406
1812	2610	649,208	177,422	22,117	340,626	540,165	109,043		39,378
1813		703,155	221,848	20,605	438,559	681,012	22,143		39,540
1814		730,370	234,354	17,170	475,602	727,126	3,244		41,736
1815	3000	1,043,065	241,901	18,441	487,779	748,121	294,944		43,748
1816	3260	961,782	265,944	16,508	521,970	804,422	157,360		48,673
1817	3459	1,002,973	303,916	23,410	589,189	916,515	86,458		52,089
1818	3618	1,130,235	346,429	24,792	664,611	1,035,832	94,403		59,473
1819	4000	1,204,737	375,828	24,152	717,881	1,117,861	86,876		67,586
1820	4500	1,111,927	352,295	26,206	782,425	1,160,926		48,999	72,492
1821	4650	1,059,087	337,599	31,003	815,681	1,184,283		125,196	78,808
1822	4799	1,117,490	355,299	23,655	788,618	1,167,572		50,082	82,763
1823	5043	1,130,115	360,462	29,069	767,464	1,156,995		26,880	84,860
1824	5182	1,197,758	383,804	35,276	768,939	1,188,019	9,739		84,860
1825	5677	1,306,525	411,183	32.214	785,646	1,229,043	77,482		94,052
1826	6150	1,447,703	447,727	33,885	885,100	1,366,712	80,991		94,052
1827	7003	1,524,633	486,411	40,203	942,345	1,468,959	55,574		105,336
1828	7651	1,664,759	548,858	55.873	1,086,312	1,691,044		26,285	114,536
1829	8050	1,773,990	575,165	58,873	1,245,269	1,879,307		105,317	114,780
1830	8450	1,919,300	615.476	71.477	1.272,156	1,959,109		39,809	115,176

TABLE LXVI.

Showing the Distance from Washington to the Capital or largest town of each State; also, the Distance from each Capital or largest town to each of the others.

	Washington.	Portland.	Portsmouth.	Montpelier.	Boston.	Providence.	Hartford.	New York.	Trenton.	Philadelphia.	Wilmington.	Baltimore.	Richmond.	Raleigh.	Charleston.	Savannah.	Cahawba.	Monticello.	New Orleans.	Murfreesboro.	Frankfort.	Columbus.	Indianapolis.	Vandalia.	St Louis.
Washington City		554	492	524	436	410	336	227	167	137	110	38	123	288	544	657	915	1230	1260	708	565	418	603	808	879
Portland, Me.	554		54	150	118	158	218	341	401	431	459	559	719	842	1098	1211	1469	1784	1814	1262	1119	852	1064	1242	1331
Portsmouth, N. H.	492	54		145	56	96	156	279	340	369	397	469	629	780	1036	1149	1407	1722	1752	1200	1057	790	1002	1130	1269
Montpelier, Vt.	524	150	145		160	190	188	311	357	387	415	487	647	812	1068	1181	1439	1754	1734	1232	1039	822	1034	1212	1301
Boston, Mass.	436	118	56	160		40	100	223	283	313	341	413	573	738	994	1107	1351	1666	1696	1144	1001	734	946	1124	1213
Providence, R. I.	410	158	96	190	40		74	197	257	287	315	387	547	712	968	1081	1331	1646	1676	1124	981	715	927	1105	1193
Hartford, Conn.	336	218	156	188	100	74		123	183	213	241	313	473	638	894	1007	1253	1568	1598	1046	903	636	848	1026	1115
New York, N. Y.	227	341	279	311	223	197	123		60	90	118	190	350	515	771	884	1142	1457	1487	935	792	525	737	910	994
Trenton, N. J.	167	401	340	357	283	257	183	60		30	58	130	290	455	711	824	1032	1397	1427	875	732	465	677	855	944
Philadelphia, Pa.	137	431	369	387	313	287	213	90	30		28	100	260	426	681	794	1052	1367	1397	845	702	435	647	825	914
Wilmington, Del,	110	459	397	415	341	315	241	118	58	28		72	232	397	653	766	1024	1339	1369	817	674	415	627	805	894
Baltimore, Md.	38	559	469	487	413	387	313	190	130	100	72		160	325	581	694	953	1268	1298	746	703	433	645	823	890
Richmond, Va.	123	719	629	647	573	547	473	350	290	260	232	160		165	421	534	792	1107	1137	652	541	472	704	821	855
Raleigh, N. C.	288	842	780	812	738	712	638	515	455	426	397	325	165		256	369	627	942	972	548	533	530	742	813	847
Charleston, S. C.	544	1098	1036	1068	994	968	894	771	711	681	653	581	421	256		113	436	753	768	530	635	708	844	894	921
Savannah, Geo.	657	1211	1149	1181	1107	1081	1007	884	824	794	766	694	534	369	113		378	693	713	571	730	761	875	887	998
Cahawba, Ala.	915	1469	1407	1439	1351	1331	1253	1142	1032	1052	1024	953	792	627	436	378		315	345	372	669	865	820	809	746
Monticello, Miss.	1230	1784	1722	1754	1666	1646	1568	1457	1397	1367	1339	1268	1107	942	753	693	315		147	422	719	915	870	767	699
New Orleans, La.	1260	1814	1752	1734	1696	1676	1598	1487	1427	1397	1369	1298	1137	972	768	713	345	147		486	783	965	934	847	813
Murfreesboro, Tenn.	708	1262	1200	1232	1144	1124	1046	935	875	845	817	746	652	548	530	571	372	422	486		297	485	448	468	430
Frankfort, Ky.	565	1119	1057	1039	1001	981	903	792	732	702	674	703	541	533	635	730	669	719	783	297		196	209	280	314
Columbus, Ohio.	418	852	790	822	734	715	636	525	465	435	415	433	472	530	708	761	865	915	965	485	196		232	430	510
Indianapolis, Ia.	603	1064	1002	1034	946	927	848	737	677	647	627	645	704	742	844	875	820	870	934	448	209	232		198	269
Vandalia, Ill.	808	1242	1130	1212	1124	1105	1026	910	855	825	805	823	821	813	894	887	809	767	847	468	280	430	198		94
St. Louis, Miss.	879	1331	1269	1301	1213	1193	1115	994	944	914	894	890	855	847	921	998	746	699	813	430	314	510	269	94	

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UNTERWALDEN. See Switzerland.

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VOLCANO. See Physical Geography, and Ætna, Andes, Iceland, Trinidad, Vesuvius, Vincents St., &c.

VOLTAIRE, Marie François Arouet de, one of the most celebrated and voluminous writers of any age or country, was born at Paris, on the 20th of February 1694. His father belonged to the legal profession, and had held the office of treasurer of the chamber of accounts. Like Gibbon, Voltaire, in his childhood and youth, was remarkable for the weakness of his constitution, and for bad health. But this did not affect the activity of his mind, the readiness of his wit and sarcasm, or the sprightliness of his imagination. He may be said, for example, like Pope, to have " lisped in numbers;" a fact, indeed, of which he boasted in future life. In his early years he became so eminent for those very characteristics which marked his maturer age, that Ninon de L'Enclos left him a legacy to buy books; several essays of great vigour, afterwards published, were written by him between the ages of twelve and fourteen; and he began the Henriade before he had completed his eighteenth year. Destined for the law by his father, he abandoned that study, being of too restless a disposition, cultivating poetry and satire too ardently, and being at the same time too eager for literary distinction to prosecute that profession with any degree of energy and success.

> Nec patiens corpus, nec mens fuit apta labori,
> Solicitaeque fugax ambitionis erat.

His talents and acquirements were of so captivating a nature that they obtained for him introduction into the first circles both of genius and rank; hence his remark when speaking of his companions, while he was very young, " we are all princes or poets." His tendency to satire and irony was not long in being displayed; and, notwithstanding the number of his powerful friends, he was, in 1717, committed to the Bastile for some poignant philippic against the government. But his release from confinement was not less honourable to him than his imprisonment itself had been disgraceful. His tragedy of Oedipus having, in the subsequent year, been represented with great success, the Duke of Orleans, having, on account of this performance, taken an interest in the author, got him restored to freedom. From this date, his life, as it indeed had always been, was devoted to literature. Meanwhile several copies of the Henriade, which poem he had endeavoured to suppress, having got into circulation, the author, in order to check the effect of such surreptitious copies, published it under the title of the League. The work, however, did not meet with that favour and success which he expected. His eulogy on Queen Elizabeth and other parts of it gave such offence that an attempt was made to get it suppressed. This attempt, though unsuccessful, so hurt his feelings that he resolved to abandon France and visit England, a land of liberty, in order to finish the poem there and publish it. This was one of the most fortunate steps in his life. He was received in England with such favour, and the subscription to his work met with such encouragement, being promoted even by his majesty George I. and the Princess of Wales, afterwards queen, that he realized a large sum of money from the publication. This was the beginning of his fortune, which was afterwards very great. The money thus obtained, he invested, on his return to France in 1728, in a lottery, which to him proved a most fortunate speculation; and by other speculations, independent of literature, such as engaging in trade and becoming a government contractor, not to speak of pensions which he got, he ere long amassed a large fortune.

But the Henriade was not so deserving of hostility on the part of the government, or the public, as many of his subsequent publications. His *Lettres Philosophiques*, abounding with most indecent attacks on revealed religion, were burned by a decree of the French legislature, and a warrant was issued for apprehending their author. Voltaire, however, having withdrawn and taken shelter under the roof of the Marquise du Chatelet, whose chateau of Cirey was situated on the borders of Champagne and Lorraine, the storm soon subsided. Ere long, indeed, through the interest of this celebrated woman, and of the famous Madame de Pompadour, he became a great favourite at court, being appointed a gentleman of the bed-chamber in ordinary, and historiographer of France. Meantime, having devoted his time to the study, not merely of polite literature, but of the systems of Leibnitz and Newton, he had produced many of his most eminent works, particularly plays. He was admitted a member of the Academy of Sciences, and had altogether become one of the most illustrious writers in Europe of his time. He at first entered into a literary correspondence with Frederick the Great of Prussia, and afterwards, on invitation, went to reside at Sans Souci, the palace of that monarch, who, among other marks of respect, conferred on him a pension of twenty thousand livres. This connexion, however, was not of long continuance. Maupertuis, who lived at the same court, and Voltaire having quarrelled, the former involved the subject of this article in a misunderstanding with the king. A separation was the consequence. After some little delay, Voltaire, probably weary of the uncertainty of court favour, settled in 1755 at Geneva, where, after a residence of twelve years, he purchased the Castle of Ferney, a place on the French frontier, three miles from Geneva: which continued to be his home, consecrated to literary retirement, till within a few months of his death. Here he was visited by all travellers who entertained any admiration for genius: indeed, some of the most illustrious men of the age visited him at Ferney: Catharine of Russia sent an embassy from her distant capital to the French philosopher on the bank of the lake of Geneva, to pay homage to him and to make presents. In several instances he showed the benevolence of his disposition, and his hatred at despotism, by the interest he took in the cause of suffering humanity and of oppressed innocence. We allude in particular to the case of John Calas, a protestant merchant at Thoulouse, whose son [1761] having committed suicide, after having become a catholic, was supposed to have been murdered by the father in consequence of having changed his religion. The suspicion was unfounded; but the local magistrates, having on false grounds obtained the sanction of the parliament of the kingdom, on mere prejudice condemned the whole family to the torture; and Calas himself was afterwards burnt as an obstinate heretic. Voltaire could not look on such a proceeding with indifference. He afforded the widow an asylum, and exerted his influence in her favour. He applied to the council of state and to parliament; and he succeeded in getting the horrible proceedings referred to annulled as illegal and disgraceful, the local magistrates degraded, and Calas and his family declared to have been innocent. Nor was this the only instance we can trace of the benevolence of his heart, and of his hatred at persecution and oppression. Ere long he had successive opportunities of vindicating the innocence of two other condemned families, which he did with a sympathy and an energy highly honourable to his character both as a man and a patriot. Many other circumstances might be detailed to show that he was a ready benefactor and a bountiful friend. Amid the profanity and the licentiousness by which his character and writings were marked, it is consolatory to dwell on any circumstance so opposite and so amiable.

Voltaire was now far advanced in years, and having spent eleven years, chiefly devoted to literary pursuits at Ferney, he resolved, from some trifling causes, to pay a visit to Paris. His reception on the way and on his arrival at that capital constitute a noble tribute to intellectual superiority and literary distinction, and must have been unspeakably delightful to the venerable philosopher. The most renowned conquerors were never received with greater honour. He was even crowned publicly with laurel in the theatre on the representation of Irene, one of his dramatic compositions. But this extraordinary exhibition was the cause of shortening his days, already far advanced. He never recovered from the fatigue and excitement consequent upon it, together with the bustle of receiving the numerous distinguished visitors, and of conversing with them. He was seized with spitting of blood, and his spirits and strength being very much exhausted, he took so large a quantity of a sudorific draught that he slept for forty-eight hours: shortly after he awoke, and after saying to his valet de chambre, whose hand he grasped, *Adieu, mon cher Morand, Je me meurs*, he expired without a groan or a struggle. This event took place on the 30th of May 1778, in the 85th year of his age.

He died unmarried. His writings were equally miscellaneous and numerous, including poetry, the drama, history, philosophy, romance, &c. and extending to no fewer than sixty volumes octavo, according to the recent edition of Renouard. They are more specious and brilliant than solid or correct. He was a violent enemy to the Christian faith; but all his attacks and irony on this subject, though they unfortunately had a temporary effect, particularly in his native country, have now lost their power, and the doctrines of the gospel stand on ground as high as before. His wit, his irony, his sarcasm, his speciousness were unrivalled: but he was not a deep thinker, and he has thrown no new light on any subject. The *Lives* of Voltaire are very numerous, but that published by his secretaries Longchamp and Wagniere, at Paris, in two volumes in 1826, is the best. See also *The Foreign Review*, vol. iii. pp. 419—75, for an able analysis of his genius and character. Respecting the best editions of his works, see Dibdin's *Library Companion*, pp. 770—2. T. M.

VOLTA, Alexander, was born at Como on the 18th February 1745, and was descended from an ancient family of that city. Among the misfortunes of his infancy, his friends have enumerated that of having a foolish nurse, and to this cause they have ascribed the slow development of his mental powers. The first exhibition of his talent was a piece of poetry; but even in his poems, which were composed in Latin and Italian, he already pointed out the subjects which were likely to demand the efforts of his genius. He soon published, indeed, a paper in prose on the phenomena of electricity, and on a new apparatus destined to carry on discoveries in this branch of physics.

After having completed the course of studies in the university of Como, he was appointed regent of it, and subsequently obtained the chair of natural philosophy. From Como he went to the university of Pavia, where he devoted to science the labours of thirty years, and dignified the name of his country with deeds of intellectual renown, which fixed the attention of Europe, and formed an era in the history of the human mind.

One of the first inventions of Volta was that of the electrophorus, which he described in June, 1775, and of which he published an account in *Rozier's Journal de Physique*, for September 1776. This ingenious instrument consists of a metallic and a resinous plate, by the successive contact of which electricity may be perpetually developed. M. Wilcke had made some considerable approaches to that invention, and consequently the honour of it has been claimed for him by his countrymen; but there can be no doubt that the electrophorus, as an instrument, is an invention entirely new, and that its eminent author was not even acquainted with the previous experiments of the German philosopher.*

During his summer vacations, he was in the habit of performing journeys of considerable length. In 1777 he travelled through Switzerland, and, accompanied by his friend the Count J. B. Giovio, he paid a visit to the celebrated Haller at Berne, when that great man was sinking under the accumulated infirmities of age and disease. They visited also Voltaire at Ferney.

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* See Wilcke, *Disputatio Experimentalis de Electricitatibus contrariis*, Rostock, 1757; and our Article ELECTRICITY.

In 1770 and 1777 Volta published some remarkable letters on the inflammability of air disengaged from marshes. They were addressed to Father C. J. Campi, and were afterwards translated into French and German. In the same year he invented his hydrogen lamp, and his electrical pistol, instruments which are well known to all who have attended an experimental course of chemistry and physics. The hydrogen lamp now forms an elegant piece of furniture, in which a light can be at all times obtained. A stream of hydrogen gas is made to issue from a small aperture by means of the pressure of a column of water, and the gas is kindled by a spark from an electrophorus placed below. About the same time Volta discovered the eudiometrical process of determining the relative proportions of the two gases, oxygen and azote, which compose atmospherical air. A given measure of hydrogen gas being put into a glass tube with a quantity of atmospheric air, it was inflamed by the electric shock, and the quantity of oxygen was indicated by the diminution of volume.

During his travels in Tuscany, in 1780, he studied with particular care the fires which burn among the Apennines, on the road from Bologna to Florence, and which are known by the name of the *Vulcanneto di Pietra Mala*. Of these he published a description, in which he first explained how these fires, as well as those which spring from the ground near the ancient city of Vellega, arise from the combustion of atmospheric air disengaged from the ground.

In 1782 Volta invented an electrical condenser for rendering sensible small quantities of electric fluid; and in the same year he performed a tour through Germany, along with his celebrated colleague M. Scarpa. After his friend parted with him, he extended his tour to Holland, England, and France. On his return from that journey, he introduced into Lombardy the culture of the potato, which he had observed in Savoy; and the peasants who first cultivated this valuable article of food were rewarded with the prize offered by the Patriotic Society of Milan.

The curious experiment of Galvani in 1790, on the electricity of the muscles of frogs gave a vigorous impulse to physical inquiry throughout Europe. Volta took a deep interest in the new science to which Galvani's experiment has given the name, and he had the good fortune to establish it on a scientific basis, and to extend its boundaries by the most important discoveries and inventions. Valli, Fowler, and our countryman Dr. Robison, had preceded Volta in their galvanic inquiries, and the latter had made a slight approach to the invention of the pile, by discovering the sensation of taste which was excited when the tongue was applied to the edges of a number of plates of zinc and silver placed alternately upon each other.

The first researches of Volta were transmitted to the Royal Society of London, in 1793, in the form of two letters to Mr. Tiberius Cavallo, entitled, *Account of some discoveries made by M. Galvani of Bologna, with experiments and observations on them. Phil. Trans.* 1793, vol. lxxxiii. p. 10. These letters contain a perspicuous account of the discoveries of Galvani, with a notice of many curious experiments of his own. He overthrows the opinion of Galvani, that the animal body has an analogy to the Leyden phial; he found that two different metals were necessary to produce the effect; and he concluded that muscular contractions arise from small portions of electricity liberated by the mutual action of the metals. He found that the nerve was the organ on which the galvanic influence immediately acted, but that, if a part of a muscle be laid upon two different metals, and a communication established between them, a contraction is produced. He then explains all the phenomena on the principle, that when two metals are brought into contact, a destruction of the electrical equilibrium takes place, and the one of them gives to the other a portion of its natural electricity, the one becoming positive and the other negative. He regards this as a new law of electricity, and he lays claim to the merit of its discovery.

The great discovery of Volta, and that upon which his reputation will always rest, is that of the pile, which is now known by the name of the Voltaic pile. This grand invention was made previous to 1800, and having been elected a Fellow of the Royal Society of London, in 1791, he communicated an account of it in two letters to Sir Joseph Banks, which appeared in the *Philosophical Transactions* for that year. In consequence of the war, however, which then raged between England and France, one portion of the paper reached Sir Joseph several months before an opportunity occurred of sending the remainder. Hence the publication of the invention was delayed; but the apparatus was constructed in London, and very curious experiments were made with it by different gentlemen in that city before the original paper of Volta was laid before the public. This instrument consisted of two perfect and one imperfect conductor of electricity, viz. silver and zinc, or copper and zinc, which were the perfect conductors, and a piece of card or leather soaked in salt water, and a little smaller than the metal plates, which formed the imperfect conductor. When one hand was placed on the uppermost conductor, and the other on the lowest, a shock was felt similar to that of the Leyden phial. Its chemical actions were still more important, and are too well known to require any notice in this sketch.

In 1821 Volta was invited to Paris. He repeated in the presence of the First Consul, and before the Institute, his experiments with the pile. These experiments were highly successful; and in order to mark an epoch so remarkable in the history of science, that distinguished body presented him with a gold medal with this inscription, *A Volta, la Classe des Sciences Mathematiques et Physiques*. In the following year the Institute sent him another, with the inscription *A Volta, associe etranger;* and most of the academies of Europe were proud to enrol his name in the list of their members.

From Paris Volta repaired to Lyons to assist in the character of deputy from the university of Pavia, at the meeting which was convoked in that city to elect a President of the Italian Republic. When the election was over he was seized with a serious illness, which obliged him to remain some months at Lyons, and afterwards at Geneva, where he experienced the most hospitable reception from the learned professors of that city, with whom he had long been on habits of the most intimate friendship.

The honours which our author thus received in foreign countries were followed by others conferred upon him at home. He was raised to the rank of a count, and thus became a senator of the kingdom of Italy. In this capacity he was obliged to spend part of the year at Milan, and he repaired every evening to the parties of Paradisi, President of the Academy, at whose house were assembled the most distinguished individuals of the country.

In the year 1804 he had obtained leave to retire from his professorship, on the condition of his giving a few lectures every year. On this occasion Napoleon said to him, "Great men die on the field of honour." Volta never forgot this saying, and after the fall of Buonaparte, he said, in allusion to it, "He, however, has not kept his word with me."

Living in a frontier town, Volta was one of the first Italians who presented himself to Buonaparte when he entered Italy for the first time. His fellow-citizens sent him in 1796, along with Count T. B. Giovio, to request the protection of the conqueror. From that time Buonaparte never lost an opportunity of honouring Volta. He conferred upon him the orders of the Legion of Honour, and of the Iron Crown, and the titles of Count and Senator of the kingdom of Italy; and at the formation of the national Institute of Science and Letters, when they were deliberating in his presence whether they should draw up a list of the members in an alphabetical order, Buonaparte wrote at the head of a sheet of paper *Volta,* and delivering it to the secretary he said, "Do as you please at present, provided that name is the first." Volta married in 1794, and had three children. He took a particular charge of their education, and he felt most bitterly the loss of one of them, who had given great promise of being a mathematician. In returning to spend the remainder of his days in his paternal mansion at Como, he experienced the greatest comfort from the affection and tender solicitudes of his family. He had now given up his studies, and having been seized with a fever, he died after two days illness on the 5th March, 1827. His death was universally lamented, and at a meeting of his fellow-citizens, called on purpose on the 23d of March, it was resolved to strike a medal and erect a monument to his memory. On the modern façade of the public schools of Como, in the middle of the busts of Pliny, Giovio, and other great men who were natives of this place, an empty niche was left as a compliment to the genius and modesty of Volta.

To all the domestic virtues, Volta added the most sincere piety, and his last moments were marked with expressions of religious feeling. As a citizen he was highly esteemed, and his fellow-countrymen entrusted him with all their public concerns, which he managed with the utmost intelligence and integrity.

In 1816 a complete collection of his works was published by the Chevalier Vincent Antinori at Florence, entitled *Collezione delle Opere del Cav. Conte Alexandro Volta.* It was dedicated to Ferdinand III. Grand Duke of Tuscany, and is embellished by an excellent likeness of the author by Morghen. In order to complete this collection it is necessary to add, 1. The Latin poem which we have already mentioned. It treats of the principal phenomena of physics and chemistry. 2. An Italian poem on Saussure's Voyage to Mont Blanc, and some other pieces in verse. 3. Observations and experiments on vapours: and 4. A number of articles on physics and chemistry, either unpublished, or scattered through the pages of periodical and other works.

VOLTAIC BATTERY. See Galvanism.

VOSGES, a department in the N.E. of France. Its area is about 2400 square miles, or 587,955 hectares. It is covered with mountains and forests, interspersed with vallies. The Meuse, Moselle, Meurthe, and the Saone rise in this department. The productions are oats, barley, rye, potatoes, flax and hemp; and wheat grows in the more fertile parts, and the vine on those of best exposure. There are two mines in the department, and manufactures of linen and cotton cloth and lace. These articles, with cattle, butter, cheese, glass, timber, and earthenware, are the principal exports. Epinal is the capital. The population in 1827 was 379,839.

UPSAL, one of the handsomest towns of Sweden, in the province of Upland, is situated in an open and fertile plain on the small river Sala, which is diminishing very rapidly in size, which divides it into two equal parts. It is a small but neat town, and the streets are formed at right angles from a central square. Most of the private houses are of wood, some of brick, but the public edifices are of stone. The wooden houses are painted red, and their roofs covered with turf. Each house has a small court yard or garden. The cathedral is a large structure in imitation of Notre Dame at Paris. Though built of brick, Kuttner describes it as one of the finest churches he has seen. The interior is fine Gothic, and there is a splendid row of massive columns in it. Among the relics in the Sacristy is a human head of oak, called the image of Thor. The monument of Gustavus Vasa is in a private chapel. It is oblong and of marble, with pyramids at the angles. His figure is of marble between those of his two first wives, who were buried in the same tomb. Near the altar stands a silver coffin, containing the bones of Eric XIV., the eldest son of Gustavus Vasa. Linnæus is buried in the west end of the cathedral, a flat marble stone lies over him, with his name and the date of his death. On the north side of the cathedral there is an elegant porphyry monument erected to his memory by his pupils. It bears a medallion with the inscription *Carolo a Linne Botanicorum Principi. Amici et Discipuli.* The University of Upsal has been long celebrated. It was founded in the 15th century, and contains at present above 1000 students. There are 24 professors, who lecture frequently in their own houses. The students lodge in the town, and there is no academical discipline. The University has a valuable library of 52,000 volumes, containing many valuable books and MSS., one of which is a MS. of the four gospels in Gothic, called *Codex Argenteus*, from its silver letters. The other objects of interest in this town are the royal castle and gardens, situated on an eminence near the town, the archiepiscopal palace, the observatory, the botanic garden of Linnæus, &c. the new botanic garden, and the cabinets of natural history and mineralogy.

The Royal Society of Upsal is the oldest association of the kind in Sweden. It was established in 1820. Its first transactions were a sort of review of books, entitled *Acta Literaria Suecіæ.* In 1730 the reviews were dropped, and it published regular transactions, which, with an interruption from 1750 to 1752, during which interval the society was abolished, have been irregularly continued. Population about 5000. See Kuttner's *Travels*, sect. x., but particularly Dr. Thomson's *Travels in Sweden*, chap. viii. and ix. p. 150-186, which contains very full and interesting details respecting Upsal and its University.

URALIAN MOUNTAINS, a celebrated chain of mountains which forms the boundary between Europe and Northern Asia. They extend from north to south about 1500 English miles. Commencing between the Caspian and Lake Aral, they reach their greatest size and altitude about the sources of the Ural, the Tobal and the Emba, and passing the sources of the Tshussovaia and the Irets, and farther on the sources of the Petshara of the Sosva, they form two great promontories about the Kassanhaven of the frozen sea. Divided by the straits of Waygatz, they terminate in the mountains of Nova Zembla.

The Uralian chain consists of granite and other primitive rocks, and it abounds in valuable metals and precious stones. These important productions are found principally on its eastern declivity, and consist of *gold* platina, the osmiuret of iridium, the diamond,* zircon, sapphire, amethyst, ruby, topaz, beryl, garnet, ceylanite, and anatase, recently discovered by M. Rose, and other valuable substances found in India and the Brazils.

This interesting region has been recently examined with much diligence by MM. Hoffman and Helmerson, and MM. Ledebour, Meyer and Bunge. The celebrated travellers Baron Humboldt and MM. Rose and Ehrenberg have likewise examined it, and we may soon expect the most interesting details respecting that important region. A general account of the labours of these travellers will be found in Baron Humboldt's discourse pronounced before the Russian Academy of Sciences on the 18th November 1829, and published in Dr. Brewster's *Journal of Science*, No. IV. p. 286. New Series, April, 1830.

URANIUM. See CHEMISTRY and MINERALOGY, *Index*.

URI. See SWITZERLAND.

UTICA, an inland town of the state of New York, in the county of Oneida, and nearly the geographical centre of the state. It is situated on an acclivity, gently rising from the south side of the Mohawk river, which has its sources in the northern part of Oneida, and the southern part of Lewis county. Its latitude is 43° 6′ north, and its longitude 1° 41′ east from the meridian of Washington. It was formerly called *Old Port Schuyler*, from a military post of that name established here to complete the chain of communication between Fort Stanwix, from which it was distant about sixteen miles south east, and Schenectady. Fort Stanwix is particularly memorable on account of a siege it sustained during the revolutionary war, against General St. Leger with a combined force of British and Indians. It was in marching to the relief of this post that General Herkimer was drawn into an ambush in a ravine near Oriskany,† and defeated by Sir John Johnson with a party of Indians, Herkimer himself being amongst the slain. Fort Stanwix was a very important position, as it was at the head of the navigable waters of the Mohawk, and, by means of a portage of a mile to Wood Creek, afforded a ready communication, by Oneida Lake and the Oneida and Oswego rivers, with Fort Oswego; and by the Seneca River with the Cayuga and Seneca Lakes. Old Fort Schuyler was also the scene of several skirmishes between the Indians and the whites; the flats of the Mohawk, and the country adjoining, being the possession of the Mohawk tribe, who were acknowledged by the other tribes of the Maquas or Iroquois, to be the "true old heads of the confederacy." This *tribe* having remained faithful to the British throughout the revolution, finally forsook their town at Fort Hunter and removed to the province of Upper Canada, in 1780, under the auspices of Sir John Johnson.

That part of the valley of the Mohawk which lies within the present limits of Oneida county, is from one to five miles wide, the land being mostly a perfect level. It does not appear to have held out the usual temptations of such a country to the early Dutch settlers; for the first settlement west of Herkimer was made in the year 1784, by Hugh White, an emigrant from Middletown, in Connecticut. He erected a log habitation at the present village of Whitesborough, about four miles westward from Old Fort Schuyler, and in what was then known as the county of Montgomery, embracing the whole region west of the county of Albany. In two or three years after, the towns of Clinton and New Hartford were begun to be settled by emigrants from the eastern states; and, in the year 1789, John Post, Uriah Alverson, Stephen

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* See Dr. Brewster's *Journal of Science*, No. IV. p. 261, New Series, April 1830.

† *Oriskany*, the *tall nettles*.

Potter, and others, formed a settlement at Old Fort Schuyler, the prosperity of which was soon determined by the laying out of a road through the extensive wilderness, from Canandaigua, "*the Chosen Place*," (now Canandaigua,) to the Mohawk. This road was opened in 1796, and intersected the river near Old Fort Schuyler. The settlement now increased rapidly, and two years afterwards it was incorporated as a village with its present name, *Utica*.

In 1798 the county of Oneida was set off, by the legislature of the state, from the extensive county of Herkimer, which, in earlier times, had been set off from the *county of Montgomery;* and it may be useful, before we proceed with the immediate subject of these remarks, to take a very brief general view of the statistics of Oneida, inasmuch as the importance of the town of Utica mainly depends upon the character and advantages of the country by which it is immediately surrounded.

The county of Oneida is bounded by the counties of Lewis, Herkimer, Otsego, Madison, and Oswego. It was early parcelled out to different proprietors, either by patents from the crown of England, or from the state of New York. A large tract was reserved for the residence of the Oneida tribe of Indians; and a portion on the Oneida creek was by them allotted to the Stockbridge and Brotherton tribes, who emigrated from Massachusetts for the purpose of being near a race of kindred habits and disposition. Most of these Indians have removed to the territory about Lake Michigan, and their lands have fallen either into the possession of the state, or of the holders of the right of preemption. The few that remain cultivate the land, and live like the lower classes of agriculturists in their neighbourhood.

This county presents a pleasing alternation of hills, valleys, and extensive flats, repaying the labours of the husbandman with a most ample return in the production of all the varieties of grain and fruit. The more hilly parts are frequently devoted to the dairy, and the raising of sheep and horned cattle. The town of Steuben, in the northeastern part of the county, sends annually large supplies of butter and cheese, the staple products of the Welsh population, to the New York market. In other parts, as on the borders of Wood Creek, and in some portions of Boonville, where the labours of agriculture have not been so assiduous and continual, the low grounds are marshy, and as yet unfit for cultivation; but the influx of inhabitants, and the hand of industry, will soon render most of these valuable for the various purposes of husbandry. In the parts south of the Mohawk, intersected as they are by bountiful streams, agriculture and manufactures go hand in hand; and pleasant thriving villages and hamlets strike the eye of the traveller in constant succession.

The soil is various, but generally rich. The valley of the Mohawk is not more celebrated for its picturesque landscape, than for its extraordinary fertility. This character is also common to the low lands bordering upon the Oriskany and Sauquoit creeks. The soil of the flats of the Mohawk is a moist alluvion, enriched yearly by the overflowings of the river, like the low countries of Egypt by the inundations of the Nile.

Oneida county is subdivided into twenty-five towns. Its area is 1101 square miles, equivalent to 704,740 acres of land. Of this about 215,000 acres are in a state of cultivation, and the residue wild lands, which are yearly becoming more valuable on account of the forests of excellent timber with which they are clothed.

The inhabitants are well educated. There are in the county 343 common school districts in which teachers are employed on an average of eight months in the year. In 1830 the state expended $7277 for the support of common schools here. The amount paid to the teachers of these schools, during the same year, was $11,000; and the number of children who received instruction was about 20,000. Besides these, there are numerous institutions of a higher order, of which the principal are Hamilton College, at Clinton; the Oneida Institute, near Whitesborough; the Clinton, Whitesborough, Bridgewater, Steuben and Stockbridge Academies; and an academy and two high schools at Utica.

The early settlers were chiefly from the eastern states; but the character of the inhabitants is now quite as diversified as the aspect of the country. Every part of the world has furnished its representatives; and there are settlements of Swiss, Italians, Germans, Dutch, Welsh, and Irish. The population in 1820 was about 57,000. In 1830 it was upwards of 71,000, exhibiting an increase in ten years of 14,000.

The chief boast of Oneida county is in its mills and manufactories, it being second, in this respect, only to the county of New York. It is remarkably well watered; in the western and northwestern parts by the tributary streams of the Oneida Lake, and in the northeastern, eastern and southern, by the Black River, the West Canada Creek, the Mohawk, and their respective tributaries. Most of these streams afford an abundant water power for the propulsion of machinery. On their borders there are now in active employment, 13 cotton factories, most of them on an extensive scale, 12 woollen factories, 67 grist mills, 165 saw mills, 6 oil mills, 60 fulling mills, 61 carding machines, 11 iron works, and 7 trip hammers. The cotton factories afford constant employment to 120 men and 890 boys and girls. They also employ about 640 looms, and 26,000 spindles. The Oriskany woollen factory employs 47 men and 69 girls and boys, has 1500 spindles, 30 power looms, and 5 hand looms for broad-cloths and cassimeres, and manufactures annually $130,000 worth of goods. Of the manufacturing companies twenty are incorporated. There are, besides those above enumerated, several glass factories and potteries.

The Sadaghqugheda Creek (*Sarequoit*) rises in the south part of Paris, and flowing through the towns of New Hartford and Whitestown, discharges itself into the Mohawk, about three and a half miles above Utica. On this stream, twelve miles in length, are 16 cotton and woollen factories, 14 saw mills, 5 flour mills, 1 oil mill, 2 plaister mills, 3 fulling mills, and 3 carding machines. Of the cotton factories, the New York Mills may challenge a comparison with any in the state for the substantial beauty of the buildings, and the excellence and finish of the machinery. They employ 7032 spindles, 197 looms, and 250 boys and girls.

The Erie canal enters the western limits of the county about five miles southerly from Oneida Lake. It takes a semicircular course to Rome, and thence runs parallel with the Mohawk to Utica. Throughout this distance there are no locks, it forming a part of the long level from Frankfort, in Herkimer county, to Syracuse, in Onondaga county. The canal is abundantly supplied with water by a feeder from the Mohawk at Rome.

The foregoing view will give a faint general idea of the advantages which the town of Utica possesses from its situation. From the period of its incorporation until the completion of the middle section of the Erie canal, its augmentation, though substantial, was not remarkably rapid. In 1813 it numbered only 1700 inhabitants. It was, however, the centre of intercourse between the lakes and the cities of Schenectady and Albany; the Mohawk river affording a tolerable communication with the former place. The great western turnpike from Albany to Buffalo also offered great facilities for inland commerce, and Utica became the deposit of the products of the northern, southern, and western back country. But when the great channel of intercourse between Lake Erie and the Hudson river approached its consummation, the business, wealth, and population of the place rapidly increased, and it is now become one of the most flourishing and substantial towns in the state.

In the year 1793 the first mail west of Canajoharie was transported, by Simeon Pool, from that place to Whitestown, in pursuance of an arrangement with the Post Office Department that the inhabitants along the route should convey it at their own expense. The distance was fifty miles, and twenty-eight hours were allowed the post-rider to complete it. This contract soon passed into the hands of the late Jason Parker, Esq. a man of much enterprise, who was the founder of the great lines of stages which now traverse this country in every direction. To his activity Utica is largely indebted for her extraordinary facilities of intercourse with every part of the state. At the time of his decease, in 1830, there were eight regular daily lines of stages running *east and west* from Utica, in which he was, or had been, deeply interested. Besides these, there were twelve weekly, semi-weekly, or daily lines running southerly and northerly. One hundred and eight regular stages left the place, and about sixty mails arrived and departed weekly. In addition to these conveyances by land for the mails and travellers, there are two lines of packet-boats on the Erie canal, which leave Utica daily for Schenectady, and also one for Buffalo, and one for Syracuse. These boats are commodious and pleasant, accommodating comfortably from thirty-five to forty passengers.

Utica contains three banking institutions in excellent repute; the Bank of Utica, with a capital of six hundred thousand dollars; the Ontario Branch Bank, with a capital of half a million; and a branch of the Bank of the United States, this place having been selected by the latter institution from about thirty applications for the establishment of a branch.

There are in this town eleven places of public worship belonging to the presbyterians, baptists, episcopalians, methodists, Dutch reformed, catholics, Welsh congregationalists, Welsh baptists, friends, and universalists. There are also an academy and court house, two high schools, two female seminaries, two infant schools, an orphan asylum, and an excellent market. It supports seven weekly newspapers. There are established here one brass and two extensive iron foundries, a manufactory of steam engines, a manufactory of oil cloths for carpeting, a steam mill and distillery, three breweries, two manufactories of cut stone, three extensive coach manufactories, three large potteries, two joiner's tool manufactories, and many others of less importance.

The United States District Court for the northern district of New York, and the Supreme Court of the state, each hold a term yearly in this town, and have clerk's offices established here.

In 1813, the population was about 1700. In 1816, 2800; in 1820, 2972; in 1823, 4000; in 1825, 5040; in 1828, 7400; in 1830, about 8500.

The appearance of the town betokens the taste and substantial prosperity of its inhabitants. The streets are wide and straight, although they do not invariably intersect each other at right angles. They are mostly well paved and flagged. The dwellings and stores are constructed principally of brick, and the style of building is neat and tasteful.

Utica aspires to become, at no distant day, the seat of the state government. Its central position entitles it to demand this honour, and the growing population of the west will sustain its claims. It needs only this additional impulse to augment it to a second rate city, respectable for its wealth and prosperity, and an ornament to the rank it may assume.

J. W. Williams.

UTRECHT, anciently Ultrajectum, a city of the Netherlands, and capital of the province of the same name, is divided into two parts by a branch of the Rhine called the Old Rhine. The approaches to the town, particularly that from Amsterdam, are very beautiful. The town, which is of a square form, is about three miles in circuit, exclusive of four large suburbs. It is encircled with an earthen mound and moat, and is defended by some bastions and half moons. The streets are of considerable width, and are intersected by canals, the level of which is 20 feet beneath the pavement. Two of these, the Vaort and the New Gracht, are crossed by 35 bridges, and run through the whole city. The houses, though ancient and of a gloomy aspect, are built of brick, and some of them are magnificent.

The principal public building is the Dome or Cathedral, part of which is in ruins. The tower is said to be 464 feet high (380 according to other accounts), and from its summit no fewer than 51 towns may be seen. The church of Notre Dame or *Buur-Kerch* has a small library, and the other parish churches are those of St. James, St. Nicholas, and St. Gertrude. The town-house is a good building, and there are well managed hospitals and charitable establishments in the town.

The university was established in 1636, having been previously a school founded by the Bishop of Utrecht. The buildings are plain, but it possesses a good library, an anatomical theatre, a botanical garden, a cabinet of natural history, and an observatory. There is also here a hall of paintings, schools for the fine arts, and several private libraries and collections.

The literary and philosophical society of Utrecht has been long established, and has published several volumes of its transactions.

Utrecht has some manufactures of fine black cloth and other woollen fabrics, which are sent chiefly to Amsterdam. Its foreign trade is small, but by means of the Rhine, it carries on a small trade with Germany. There is a fine promenade called the Mall, without the walls. It is about a mile long, and is bordered with a single row of trees. It consists of seven alleys 2000 feet long, and three crosswise. There is also an agreeable walk on the ramparts. Population about 35,000. East Long. 5° 7′ 16″, North Lat. 52° 5′ 31″.

UTTOXETER, a town of England in Staffordshire. It stands on the declivity of a hill sloping to the river Don, which is crossed by a good stone bridge. The principal streets unite in a spacious market place. The houses are good and well built, and the church is a very handsome edifice, with a lofty spire. There are several iron forges in the vicinity. The manufactures of the place are various kinds of ironmongery. Great quantities of corn, cheese, butter, &c. are sold here, and conveyed down the Don to the canal communicating with the Mersey, &c. Population of the parish in 1821, 4658. A great increase of population has taken place in consequence of a branch of the Grand Trent canal having been extended to the town.

VULTURE. See Ornithology.

UXBRIDGE, a town of England in Middlesex, is situated on the river Colne and the Grand Junction Canal, over each of which there is a bridge. It is a neat and well built town, consisting chiefly of one street about a mile long. Near the centre of it is a large and newly erected market-house. This town is celebrated for its great corn market, and its opulent mealmen, who are chiefly quakers. There are many powerful corn and flour mills in the neighbourhood, and a great deal of malt is made in the town and vicinity. The ancient building called the Treaty-house, where the commissioners of Charles I. and the parliament met in 1644 is now the Crown Inn. Population of the chapelry in 1821 was 506 houses, 595 families, 302 in trade, and total population 2750.

W.

WABASH, river of the United States, in the states of Ohio, Indiana, and Illinois. This fine stream is the great northwestern confluent of Ohio river. Beside many minor branches Wabash is composed of three main constituents; Little Wabash on the southwest; Wabash proper in the centre, and White river on the eastern side of the valley.

Little Wabash rises in Shelby county of Illinois, interlocking sources with those of Kaskaskia river, and flowing thence in a southeastern direction over Fayette, Clay, Wayne, and White counties, Illinois, falls into the main channel of Wabash, between White and Gallatin counties, about ten miles direct course above the influx of Wabash into Ohio river. The entire comparative course of Little Wabash is about 110 miles, mean breadth of its valley 25 miles, and area, 2750 square miles; between 37° 50′ and 40° 30′ N. Entire valley in the state of Illinois.

Above that of Little Wabash spreads another river valley, also entirely included in the state of Illinois, and drained into the Wabash. The river of this second tributary is named Embanas, and has its extreme source in Vermilion county, Illinois, interlocking sources with those of Vermilion, Kaskaskias, and Little Wabash rivers. Flowing nearly parallel to the latter over Edgar, Clark, and Crawford counties, falls into the main channel of Wabash ten miles below Vincennes, after a comparative course of about 100 miles; mean breadth of the valley 20, and area 2000 square miles.

Vermilion river is the next tributary stream of consequence which enters the main Wabash from the side of Illinois, above the influx of Embanas; intermediate distance about 100 miles direct course. Vermilion rises in the state of Illinois, northwardly from Vermilion county, interlocking sources with those of Embanas and Kaskaskias, and those of the Sangamon and Pickmink branches of Illinois river; flowing to the southeastward 60 miles falls into the Wabash, after having traversed Vermilion county of Illinois and Vermilion county of Indiana.

Tippecanoe, as laid down by Tanner, is the extreme northern source of the Wabash, rising at north lat. 41° 30′, and 9° W. from W. C., and interlocking sources with those of Kankakee branch of Illinois river, and with those of Elkhart or the southern branch of St. Joseph's river of lake Michigan. Flowing by comparative courses 80 miles, first to the S.W. and thence south, falls into Wabash in the northern part of Tippecanoe county, after having traversed that of Carroll. The entire valley of Tippecanoe is in the state of Indiana.

Eel river is the last confluent of the Wabash from the right. This stream rises about thirty miles to the northward from Fort Wayne, interlocking sources with the St. Joseph's river of Michigan, and with those of St. Joseph's of Maumee; flowing to the southwest by west eighty miles comparative course, joins the Wabash in Cass county.

The whole left inclined plane of Wabash sweeps a curve, concave side towards the main channel, and in length three hundred and thirty miles. The mean breadth about thirty-five miles, and area eleven thousand five hundred and fifty square miles.

Wabash proper rises on the great plateau or table land, from which flow to the northwestward St. Joseph's river of lake Michigan; to the northeastward Maumee into lake Erie; Miamee southward into Ohio, and from which flow westward the confluents of Wabash. The rivers of this comparatively elevated but level region present some remarkable phenomena. The two main confluents of the Maumee, the St. Joseph's rising in Michigan and St. Mary's in the state of Ohio, flow each for a comparative distance of seventy miles in complete accordance with the confluents of Wabash; but uniting at Fort Wayne inflect upon themselves, if the expression can be admitted, and in place of pursuing what is apparently their natural direction to S.W. down the channel of the Wabash, the waters turn to N.E. from the Maumee in Allen county Indiana, thence entering the state of Ohio, separating Williams from Paulding, and traversing Henry and Wood counties, enter lake Erie in Monroe county of Michigan, after a comparative course of a fraction above 100 miles.

This central plain with slight swells is in general so near a dead level as to admit but slight current in the streams. What is laid down by Tanner as the main source of Wabash, is a stream rising in Mercer and Darke counties, Ohio, and flowing thence N.W. by W. enters Indiana, and, after a comparative course of 60 miles, Little River from the northwest, and from the highest part of the central table land in Allen county of Indiana. The sources of the latter so nearly approach the junction of St. Mary's and St. Joseph's, or head of Maumee, as to leave at times of high water only a portage of five miles between the navigable channels. It is by this route that nature itself seems to have pointed out a channel of intercommunication between the Ohio river and lake Erie along the Wabash and Maumee rivers.

Already a navigable stream below the influx of Little river, the Wabash inflects to a course of a little S. of W. 50 miles, receiving in that distance from the south the Salamania and Mississinaway, and Eel river from N.W. With the influx of Eel river the channel of Wabash curves to S.W. and continuing that direction by comparative course 70 miles, and receiving at 30 miles below the influx of Eel river the Tippecanoe, the main channel again deflects to the left, and assumes a course but very little W. of S. At the last mentioned bend, agreeable to Tanner's United States, the main channel of Wabash is only about ten miles eastward from the boundary between Illinois and Indiana, but continues within the latter about sixty miles, separating Parke and Fountain from Vermilion, and entering Vigo county. At Terre Haute (*Highland*) the seat of justice for Vigo, the Wabash assumes a general course of a little E. of S.S.W., and ten miles below Terre Haute becomes, and so continues to its mouth, a boundary between Indiana and Illinois. The comparative distance is about one hundred and twenty miles, in which the Wabash channel constitutes the demarcation between the two contiguous states, and in this part of its course the stream is augmented by the Embanas and Little Wabash from the right, and White river from the left.

White river is the most considerable branch of Wabash, draining the large space between the main stream above their confluence, the Miami valley, and that part of Ohio river valley between the mouths of Miami and Wabash. The valley of White river, comprising an area of eleven thousand square miles, is drained by innumerable smaller streams, which, first uniting in two main branches, and which again by their union form White river. White river proper, or the northern branch, has its extreme source in Randolph county, Indiana, but very near the western border of Darke county, Ohio. Flowing thence westward by comparative courses seventy miles, over Randolph, Delaware, Madison and into Hamilton county. Inflecting to S.W. and traversing Hamilton, Marion, Johnson, Morgan, Owen and Greene, and thence separating Daviess from Knox county, joins the East Fork, after an entire comparative course of upwards of two hundred miles.

East Fork, though not having an equal length of course, drains, however, little if any less surface than does the main branch of White river. The former rises in Hancock and Henry counties, Indiana, and including all the confluents, has a general southwestern course of one hundred and fifty miles, draining the counties of Hancock, Henry, Rush, Shelby, Decatur, Jennings, Scott, Bartholomew, Jackson, Lawrence, Orange, Martin, Dubois, with part of Daviess, Monroe, Johnson, Ripley, Jefferson, Clark, Washington and Pike.

It may be mentioned as a remarkable peculiarity of the valley of White river, that the extreme southeastern source in Jefferson county rises within less than one mile from the right bank of Ohio river, but flowing directly from the latter unites with it as a final recipient one hundred and sixty miles lower down both rivers. A ridge of hills extends over the state of Indiana, from the mouth of Great Miami to that of Wabash, in a southwest by west direction, or very nearly parallel to the opposite course, and at a mean distance of about twenty miles from the channel of Ohio. From this ridge no stream above the size of a large creek enters Ohio, the principal slope being westward into the valley of White river. Below the junction of its two main branches, the channel of White river in a southwestern direction by comparative courses of thirty miles, separates Knox from Pike and Gibson counties, finally falls into the Wabash nearly opposite to Mount Carmel in Wabash county, Illinois.

The entire valley of Wabash approaches the form of an ellipsis; the longer axis three hundred miles from the extreme southwestern sources of Little Wabash to the northern fountains of Eel river. The greatest breadth two hundred miles from the sources of Graham's Fork, near Madison in Jefferson county, Indiana, to the northwestern fountains of Vermilion river, in the state of Illinois. The whole area of the valley, about forty thousand square miles, exceeding by a small fraction the one fifth part of the superficies of the whole Ohio valley.

In fixing the relative extent of the confluents of Ohio, Wabash is the third in length of course, and second in regard to area drained; being in the former case exceeded by Tennessee and Cumberland, but in the latter by Tennessee only. As a navigable channel, Wabash is very important. It is but slightly impeded by falls and rapids, and the position of its course could not be more advantageous if artificially made, to constitute a great link in a chain of intercommunication between the Mississippi basin and lake Erie.

As an agricultural section, it may be doubted whether any other of so great continuous extent, exceeds the Wabash valley. The surface is in part hilly, particularly towards Ohio river; it is no part mountainous, or to any considerable extent a dead level. The northern part exhibits features which evince an advance to the physical section "*Prairie;*" but the prairies, or natural meadows of Indiana, are of moderate extent when compared with even those of Illinois. Fertility is the general character of the whole soil of the valley.

If peopled only equal to some of the counties of Kentucky, or of Ohio, of not superior soil if taken at a mean, and excluding large towns, the valley of Wabash would sustain a population of upwards of four millions.

Geographically this fine portion of the United States stretches from north latitude 37° 47′ to 41° 30′; and in longitude from 7° 35′ to 11° 55′ W. from W. C. The difference of level between the arable extremes is not far above or below one thousand feet; or an equivalent to two and a half degrees of latitude. Adding the result of the difference of level to that of latitude, the extremes of temperature will be six degrees of Fahrenheit. The cultivated soil near the mouth of Wabash is about four hundred feet above the ocean tides, and the highest part say fourteen hundred, the mean elevation of the valley will be from seven hundred to nine hundred feet above the ocean level.

WABASH, county of Indiana, bounded by Carroll N.; Miamis N. E.; Hamilton E.; Hendricks S.; Montgomery S.W. and Tippecanoe N.W. Length thirty-eight degrees; mean breadth twenty-five degrees, and area nine hundred and fifty square miles. Extending in latitude from 39° 57′ to 40° 28′, and in longitude from 9° to 9° 40′ W. from W. C. The eastern border of this county is on the table land between the main or western branch of White river and the Wabash, but the slope is westward, and nearly the whole surface is drained in that direction towards the latter river.

On the post-office list of 1831, there is but one office named in this county, Elk Heart Plain. On Tanner's United States there is a village named Thorntown placed near its centre, and on a branch of Sugar river, about thirty-five miles N.W. from Indianopolis.

WABASH, one of the southeastern counties of Illinois, bounded W. by Bos Pas river, separating it from Edwards; N. by Lawrence; N.E. by Wabash river, separating it from Knox county, Indiana; and again E. and S E. by Wabash river, separating it from Gibson county, Indiana. It lies in form of a triangle, base twenty-two miles parallel to the general course of Bon Pas river; acute angle made by the courses of Wabash and Bon Pas; mean breadth nine, and area one hundred and ninety-eight or two hundred square miles. Extending in latitude from 38° 17′ to 38° 36′ N., and in longitude from 10° 44′ to 11° 4′ W. from W. C. This county bounds as noted on the Wabash, and stretches above and below the influx of White river, with a southern declivity

The post office list of 1831, gives, beside Mount Carmel, the county seat of three other offices, Armstrong, Centreville, and Coffeetown. Mount Carmel, the seat of justice, is situated on the bank of the Wabash, directly opposite the mouth of White river, thirty miles below Vincennes in Indiana, and by post-road, one hundred and nine miles S.E. from Vandalia. N. latitude 38° 28′, longitude 10° 48′ W. from W. C. DARBY.

WACHITAU. See WASHITAU.

WAD, a specie of manganese ore, the varieties of which have been recently analyzed with great accuracy by that able chemist, Dr. Turner. His paper on the subject is published in Dr. Brewster's *Journal of Science*, No. IV. New Series, p. 213. April 1830.

WADESBOROUGH; post village and seat of justice, Arson county, North Carolina; situated near the centre of the county, by post road one hundred and thirty-four miles S.W. by W. from Raleigh, and four hundred and ten miles S.S.W. from W. C. North latitude 35° 3′, longitude 3° 12′ W. from W.C.

WADESBOROUGH, or as written in the census tables, Waidsborough, post village and seat of justice, Callaway county, Kentucky, situated on a small branch of Clark's river, about sixty miles S.E. by E. from the mouth of Ohio; thirty miles S. from Smithland, at the mouth of Cumberland river, and by post road two hundred and sixty-two miles S.W. by W. from Frankfort, and eight hundred and one miles from W. C. N. 36° 44′. Population in 1830 one hundred and sixty-three.

DARBY.

WAHABEES. See ARABIA, Vol. II. p. 281.

WAKE, county of North Carolina, bounded N. by Granville, N.E. by Franklin, S.E. by Johnson, S. by Cumberland, S.W. and W. by Chatham, and N.W. by Orange. Length 38, mean width 30, and area of 1140 square miles. Extending in latitude from 35° 31′ to 36° 7′, and in longitude from 1° 14′ to 2° 2′ W. from W. C. A small angle along the western part is drained southwardly into

Cape Fear river; but the body of the county is contained in the valley of the Neuse, with a declivity to the S.E., the Neuse deriving its sources from Person, Granville, and Orange counties, is formed into a river on the northwestern angle of Wake, and winding thence southwestwardly, crosses the county into Johnson. Chief town, Raleigh, the capital of the state. Population in 1820, 20,102, and in 1830, 20.398. DARBY.

WAKEFIELD, a town of England, in the West Riding of Yorkshire, is situated on the side of an eminence, sloping gently to the Calder. The town, which is neat, clean, and well built, consists of nine streets, three of which are wide and commodious, and many of the houses are lofty and handsome. In the market, which is small, there is a neat building called the market cross, formed of an open Doric colonnade, supporting a dome, and containing a large room, in which the business of the town is transacted. The parish church of St. Peter's is a lofty Gothic building, but of a poor style of architecture. Its spire, which is octagonal, rising from a lofty square tower with double battlements at each angle, is reckoned the highest in Yorkshire. The church of St. John, which is finely situated at the end of St. John's place, a little out of the town on the road to Leeds, is an elegant building with a lofty steeple. The other public buildings are the town-hall, the cloth-hall, seventy yards long and ten broad, the free grammar school, a noble and spacious building, the prison, which is a large and fine stone building, containing one hundred and fifty cells, the house of correction for the whole Riding, the new banks, the auction mart, and an elegant building appropriated to assembly rooms, news-room, library, and dispensary. There is a handsome bridge over the Calder at the southeast entrance to Wakefield, and built in the reign of Edward III. This bridge is remarkable by a highly ornamented Gothic chapel, twenty feet long and twenty-four feet wide, which is built in the centre of it, projecting from the eastern side, and resting partly on the hustings. The west part facing the passage over the bridge, is particularly admired for the richness of its ornaments. This chapel was dedicated to the memory of the Duke of York, who was slain near this town in 1459.* It has been lately used as a warehouse.

Wakefield has been long celebrated for its manufacture of woollen cloths, and for being the chief wool market in the kingdom. Wakefield has also one of the greatest corn markets in England, and contains immense corn warehouses, which have been erected on the banks of the Calder, principally since 1800. The trade has been much benefited by the Calder navigation. Fairs well attended are held here on Wednesday every fortnight.

In 1821 the township of Wakefield contained 2223 houses, 2251 inhabitants, 2069 families engaged in trade, and 10,764 inhabitants. See the *Beauties of England and Wales*, vol. xvi. p. 802.

WALACHIA, a province of European Turkey, is separated on the north from Transylvania and Moldavia, by a range of mountains; while on the south the Danube divides it from Turkey. It is about 250 miles long from east to west, and its medium breadth is about 160 miles. It contains about 27,000 square miles.

The northern part of the province is mountainous, the Carpathian range to the north sending out a number of branches into the interior; in the south it grows less mountainous, exhibiting some fertile plains and valleys. The principal rivers are the Danube, with its tributaries, the Alt, the Dumbowitza, the Jalomitza, and the Sereth.

Its agriculture is in a very rude state, the mountainous tracts being covered with forests, and the extensive marshes undrained. The productions of the soil are wheat, millet, maize, beans and pease, grapes, and fruits of various kinds. The wealth of the province consists in its pastures, which support numerous herds of cattle and sheep. Horses are found in a wild state in some of the forests. Game is abundant, and also poultry and common domestic animals.

The mineral productions are gold, which is occasionally found in the sands of the rivers, salt, and saltpetre.

Walachia possesses almost no manufactures. The gypsies, who amount to about 100,000, are occupied with the manufacture of coarse hard wool. The trade of the country, which is chiefly in the hands of Jews, Greeks, and Armenians, is in a very unprofitable state. The principal imports are woollen goods, hardware, and groceries, and the exports are horses, cattle, sheep, hogs, tallow, leather, wax, butter, flax, hemp, salt and saltpetre.

The Walachians belong in general to the Greek church. Bucharest, Tergovista, Brailow and Giorgief, are the chief towns. Population about 800,000. See BUCHAREST, MOLDAVIA and TURKEY.

WALES. See ENGLAND.

WALES, NEW SOUTH. See AUSTRALASIA, Vol. III. p. 114-128. BOTANY BAY, Vol. IV. p. 350-353. DIEMAN'S ISLAND, Vol. VII. p. 585-589, and HOLLAND, NEW, Vol. X. p. 444-447.

WALKER, county of, Alabama, bounded by Blount, E., Jefferson, S.E., La Fayette, S.W. Marion, W., Franklin, N.W., and Lawrence, N. Length, from S. to N. 50 miles. Extending in lat. from 33° 35′ to 34° 17′ N., and in long. from 9° 56′ to 10° 43′ W. from W. C. Declivity southeastward, and drained by the numerous western branches of Mulberry river. The latter stream formed in this county by two main branches, Sipsay and Blackwater, flows a little westward of S. along the southeastern border, receiving the drain of the western part of Mulberry river valley. Chief town, Walker Court House. Population in 1830, 2202. DARBY.

WALLACE, SIR WILLIAM. See SCOTLAND, Vol. XVI. p. 652, &c.

WALLER, EDMUND, a celebrated English poet, was born at Coleshill in Hertfordshire in March 1605. His mother was the sister of John Hampden, and in consequence of the death of his father when he was a child, he came into the possession of an estate of £3500 per annum. He was educated at Eton and King's College, Cambridge, and entered parliament in his sixteenth or seventeenth year. When only eighteen years of age, he wrote the verses on the prince's escape at St. Andero. He died in October, 1687, in the eighty-third year of his age. His character as a poet does not rank very high. His "Divine Poems," written at the close of his life, indicate, as Dr. Johnson observes, that his piety was without weakness, and that his intellectual powers continued strong and vigorous.

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* See ENGLAND, Vol. VIII. p. 687.

WALLIS, John, a celebrated mathematician, was born at Ashford in Kent, on the 23d November, 1616, and was educated at Emanuel College, Cambridge. About 1640 he took orders, and was elected Fellow of Queen's College. In 1643, he received the living of St. Gabriel in Fenchurch-street, and in 1649 he was appointed Savilian Professor of Geometry at Oxford. He was the author of many mathematical, theological, and controversial works and papers in the Philosophical Transactions, the most important of which are his *Arithmetic of Infinities*, and his *Mechanics*, of which we have already given a sufficient account in our Article Mathematics, Vol. XII., p. 441-442, and Mechanics, Vol. XII., p. 582, 583. His mathematical works have been published by the curators of the university press of Oxford, in three vols. folio, 1697. He died at Oxford, on the 28th October 1703, in the 88th year of his age, leaving behind him a son and two daughters.

WALSALL, a market town of England in Staffordshire, is agreeably situated on an eminence on the Wyrley canal. It consists of twelve large and regularly built streets, the chief of which are formed by the roads from Lichfield, Stafford, Wolverhampton, Wednesbury, and Birmingham. The houses are neat and good, but are much blackened by the smoke of its hardware manufactories. The church, dedicated to St. Matthew, is a building of great antiquity, in the form of a cross, with a plain but elegant tower surmounted with a spire, rising from the north-west aisle of the church. The interior is lofty and spacious, and is singularly ornamented. The dissenters of different denominations have places of public worship. The town-hall is neat and commodious, and there is a good free grammar school. There are several iron mines in the neighbourhood. The principal manufactures are bits, stirrups, spurs, buckles, nails, and almost every variety of hardware. From its situation on the Wyrley and Essington canal, Walsall has the advantages of an extensive inland navigation. In 1821, the population of this parish was 2381 houses, 2488 families, 1829 ditto employed in trade, and the total number of inhabitants 11,914. See *The Beauties of England and Wales*, Vol. XIII. p. 835.

WALTON, county of Florida, bounded by Choctawhatchee Bay, or Gulf of Mexico, S.; by Escambia county in Florida W.; by Covington and Dale counties in Alabama N., and by Choctauhatchee river, separating it from Jackson E. Length along the Alabama line 52 miles, mean width 30, and area 1560 square miles. Extending in latitude from 30° 22′ to 31 N.; and in longitude from 9° to 9° 52′ W. from W. C. The general declivity is to the southward, and drained by Yellow Water and Choctauhatchee rivers. Chief town Alaque. "The Yellow Water settlement is in the N.W. part of the county, on the banks of the river of that name. Here is a small body of excellent land, very well improved for a new country. Cotton and corn are their principal crops; the pine lands, for six miles from the river, produce equally well with the river bottoms. Twelve miles S. there is another settlement, commencing on Shoal river; there they have a similar tract of land, founded on the same kind of soap-stone as on the Alaqua. See Alaqua river." "Near one third of Walton county is good tillable upland; the rest is pine barren." *Williamson's Florida.*

Darby.

WAR. See Battle, Castremetation, Military Tactics, and Tactics Naval.

WARBURTON, William, a celebrated English prelate, was the son of an attorney at Newark, and was born December 24, 1698. He was articled to an attorney of East Markham, in 1714, and he for some time practised his profession in his native city. His fondness for the church, however, induced him to take deacon's orders in 1723, and in consequence of having dedicated his first work, entitled *Miscellaneous Translations in Prose and Verse*, to Sir George Sutton, he was presented by that gentleman, in 1726, to a small vicarage. By the interest of Sir George he was placed in the list of King's Masters of Arts upon his majesty's visit to Cambridge, in 1728, which made up for his want of an academical education. By the same kind influence he was presented to the Rectory of Broad Broughton in Lincolnshire, where he continued for some years in the ardent prosecution of his studies. In 1738, he published his great work, entitled, "The Divine Legation of Moses demonstrated, or the principles of a Religious Deist, from the omission of the Doctrine of a future state of Rewards and Punishments." The second volume appeared in 1741. In 1738 he became chaplain to the Prince of Wales.

About this time he published a Defence of Pope's Essay on Man, and thus became intimately acquainted with that celebrated poet, who, at his death in 1740, bequeathed to him half his library, and the property of all his writings not otherwise disposed of, which was reckoned about 4000*l*. In 1745, he married Miss Tucker, the niece of Mr. Allen, to whom he had been introduced by Pope, and he then succeeded to the splendid seat of Prior Park.

In 1753, he was made prebend of Gloucester, and in 1754, chaplain in ordinary to the king. In 1754, he became prebend of Durham, in 1757, dean of Bristol, and in 1759, bishop of Gloucester. In 1765, there appeared the 4th edition of the 2d part of his Divine Legation, forming the 3d, 4th, and 5th volumes of that work. In 1768, he transferred 500*l*. to trustees for a lecture at Lincoln's Inn to prove the truth of Christianity from the prophecies in the New Testament respecting the Christian church. The death of his only son, who died of consumption in the 19th year of his age, made a deep impression on his mind, and he died at Gloucester, on the 7th June, 1779, in the 81st year of his age. His writings were published in 1788, in 7 vols. 4to., by Bishop Hurd, with an account of his life, writings, and character. "He was a man of vigorous faculties, as Dr. Johnson has stated, and a mind fond of retirement. His abilities gave him a haughty consequence which he disdained to correct, and his impatience of opposition disposed him to treat his adversaries with contemptuous superiority."

WARD, SETH, D. D., Bishop of Salisbury, an eminent mathematician, was born at Buntingford in Hertfordshire, in 1617. In 1632, he entered Sydney College, Cambridge; and on the expulsion of Mr. Greaves, the Savilian professor of astronomy at Oxford, he was elected to that chair. In 1654, he was chosen president of Trinity College, a situation which he was obliged to resign at the restoration. As a compensation, however, for his loss, he was appointed, in 1660, to the rectory of St. Lawrence Jewry. In 1661, he became F.R.S. and dean of Exeter, and in 1662 he became bishop of Exeter. In 1667 he was translated to the see of Salisbury, and in 1671 he was made chancellor of the order of the garter. After 1660, when he had been imperfectly cured of a fever, both his intellectual and bodily strength declined, and he closed a melancholy life in January 1699, in the 72d year of his age. His astronomical works, by which he is principally known, were, 1. De Cometis, 4to., 1653. 2d. In Ism. Bullialdi Astronomia Inquisitio, 4to., 1653. 3. Idea Trigonometriæ Demonstrata, 4to., 1654. 4. Astronomia Geometrica, 8vo., 1656. In the 3d part of this last work he proposes what is called Ward's Circular Hypothesis, by which he approximated to the true place of a planet, by supposing that though the motion is really elliptical, yet the angular velocity may be considered as an uniform circular motion round the focus of the ellipsis next the aphelion. A correction was afterwards applied to this approximation by Bullialdus.

WARE, a town of England, in Hertfordshire, is situated on low ground, on the west side of the river Lea. It consists of four streets, the principal one of which is nearly a mile long. The houses are generally neat and well built. The church of St. Mary's, which is a spacious edifice, consists of a nave, chancel, and aisles. It contains numerous sepulchral monuments, and some very ancient slabs, the brasses of most of which have been carried off. There is here a school and several alms-houses. One of the objects of curiosity at Ware is the large bed, which is said still to be seen at one of the inns. A considerable trade is carried on in the export of malt and corn, and in importing coals and groceries by means of the river. Some remains of the ancient priories of the Benedictines, and of the Franciscan friars are still to be seen adjoining the church. Population of the parish in 1821, 670 houses, 700 families, 252 ditto in trade, and total number of inhabitants 3,844.

WARE, county of Georgia, as laid down on Tanner's Map U. S., is bounded by Lowndes W.; Appling N.; Wayne N. E.; Canada E. and S.E.; and Hamilton county in Florida S. Greatest length from S. to N. 80 miles, mean breadth 43, and area 3440 square miles. Extending in latitude from 30° 20′ to 31° 30′, and in longitude from 5° 9′ to 6° 6′. Declivity southeastward. The north side is drained by the numerous sources of the Santilla river. The central and southern sections are drained by the tributaries of St. Mary's river. The latter stream has its higher sources in that tract vaguely called the Okefinoke swamp, which occupies the southern part of Ware county. The various branches oozing from this extended flat unite at or very near the line between Georgia and Florida, flows thence southward about twenty miles, curves rapidly E., and thence northeast, and still winding assumes nearly a northern course of forty miles. The point on the Florida boundary which separates Ware from Camden county is at the head of the great bend of St. Mary's river. The surface of Ware county is flat in the valley of St. Mary's, and level in that of St. Illa. Much of the soil is productive, but exposed to submersion in spring and early summer. Chief town Waresborough. Population in 1830, 1205. DARBY.

WAREHAM, a borough of England, in Dorsetshire, is situated in a peninsula formed by the rivers Frome and Biddle, near their confluence with the waters of Poole harbour. The Frome is crossed by an elegant stone bridge of six arches. The town, which is regularly built, consists of four large and wide streets intersecting each other at right angles. The houses are well built and handsome, and the whole are surrounded with a large earthen rampart. Wareham had once eight churches, but there are now only three, viz. St. Mary's, St. Martin's church, and Trinity church. St. Mary's is a lofty building with a very handsome tower. The present town hall and school houses were erected on the site of St. Peter's church. The chief business of the place consists in the digging of pipe clay from clay pits round the town, and nearly 10,000 tons are annually shipped for London, Hull, Liverpool, Bristol, and Glasgow, for the supply of various potteries. There is here a free school, a charity school, and alms-houses. A small trade is also carried on in stockings, coals, and iron, and in raising vegetables, great quantities of which are sent by water to Poole and Portsmouth. Hops grow wild in the hedges. Wareham sends two members to parliament, who are chosen by 500 voters. Population of the borough in 1821, 395 houses, 433 families, 250 ditto engaged in trade, and the number of inhabitants 1931.

WARING, EDWARD, M.D., an eminent English mathematician, was born in Shropshire, in 1734, and educated at Magdalen College, Cambridge, where he took his first degree in 1757, and was considered as a prodigy in the sciences. At the age of 25, in 1759, he was elected Lucasian professor of mathematics, and in 1762 he published his Miscellanea Analytica, which extended his reputation over Europe. In 1767, he took his degree of M.D., but he was not successful in practice, which was the less to be regretted, as he possessed a liberal patrimony. In 1776, he married, and he soon after went to reside on his own estate at Plaisly, about eight miles from Shrewsbury. His other works are his *Meditationes Algebraicae*, 1770, his *Proprietates Algebraicarum Curvarum*, 1772, and his *Meditationes Analyticae*, 1773, 1774, 1775, 1776. He published many papers in the Philosophical Transactions, vol. liii. liv. lv. lxix. lxxvi. lxxvii. lxxviii. lxxix. lxxxi. and lxxxiv., for which he received the Copley medal.

WARMINSTER, a large market town of England, in Wiltshire, is situated on the river Willey, and consists chiefly of five streets, the chief of which is a mile long, and well paved, and contains many handsome and well built houses. The principal buildings are the church, a spacious and handsome edifice with a square tower, the chapel of St. Lawrence, the town-hall and session-house, an assembly-room, and four dissenting chapels. There is here a free grammar school, and several annual benefactions. The manufactures consist of superfine woollen cloth and malt. Near the town on the Downs is a fine Belgic fortification, called Battlesbury, and about two miles from the town a Roman villa, with a fine tesselated pavement, has been discovered. Population of the parish in 1821, 1107 houses, 1202 families, 457 do. in trade, and total inhabitants 5612.

WARM SPRINGS, new county of Arkansas, and laid down on Tanner's United States Map. It embraces the country round the Warm Springs, on the higher part of the Washitaw valley, and lies about sixty miles a little S. of W. from Little Rock. Boundaries uncertain. Chief town Warm Springs.

DARBY.

WARPING OF LAND. See AGRICULTURE, Vol. I. p. 325.

WARREN, county of, New York, bounded by Saratoga S., Hamilton W., Essex N., and lake George, separating it from the northern part of Washington county, E., and by the middle part of Washington county S. E. Greatest length in common with Essex, from east to west, 40 miles, mean breadth 28, and area 1120 square miles. Extending in latitude from 43° 11′ to 43° 46′, and in longitude from 2° 40′ to 3° 25′ E. from W. C. The face of this county is broken and even mountainous. The main or northern branch of the Hudson enters it by the northern border from Essex, and pursuing a course of a little E. of S. traverses the county to the entrance of Sacondago river. Thence the Hudson inflecting first S. E. and then N. E. to Glenn's Falls, separates the southeastern part of Warren from the northeastern of Saratoga. The northeastern section of Warren along lake George, is one congeries of mountains, wild and picturesque. The general declivity is southward.

By the post-office list of 1831, besides at Caldwell, the seat of justice, there were offices at Athol, Bolton, Chestertown, Glenn's Falls, Hague, Johnsburgh, Luzerne, and Thurman.

Caldwell, the seat of justice, is situated at the head of lake George, 62 miles N. from Albany, and by post road 439 miles N.N.E. from W. C. N. latitude 43° 22′. Population in 1820, 9453, and in 1830, 11,796.

WARREN, county of, New Jersey, bounded N.E. by Sussex, E. by Morris, S.E. by Hunterdon, and by Delaware river, separating it from Northampton county of Pennsylvania W., and Pike county of Pennsylvania N.W. The form of this county approaches that of a triangle, longest line parallel to the general course of the Delaware, 40 miles, mean breadth 12, and area 480 square miles. Extending in latitude from 40° 36′ to 41° 5′ N., and in longitude from 1° 45′ to 2° 8′ E. from W. C.

This county is traversed by the Blue Ridge on the southeast, and by the Kittatinny on the northwest. The slope of surface along the mountain valleys towards the Delaware. A narrow but fine border lies between the Kittatinny and Delaware, but the body of the county is between the two chains. The surface is comparatively elevated, and no farm it contains is less than 200 feet above tide water, whilst the upper part, bordering on Sussex, rises to 600 or 700 feet.

The Morris canal from the Delaware traverses the southeastern border of this county. See CANALS.

By the post list of 1831, beside at Belvidere, the seat of justice, there were offices at Allamuchy, Anderson, Asbury, Bloomsburgh, Brotzmansville, Columbia, Danville, Gravel Hill, Hackettstown, Harmony, Hope, Johnsonburgh, Knowlton, Mansfield, Marksboro', New Village, and Ramsaysburgh.

Belvidere, the seat of justice, is situated on the left bank of Delaware, 14 miles above Easton, and by post road 54 miles N.N.W. from Trenton, and 210 miles N.E. from W. C. N. latitude 40° 48′, N. long. 1° 50′ E. from W. C. Population of Warren, New Jersey, in 1830, 18,627.

WARREN, county of, Pennsylvania, bounded E. by Mackean, S.E. by Jefferson, S. by Venango, W. by Crawford, N.W. by Erie, N. by Chataque county, New York, and N.E. by Catterangus county, New York. It lies in form of a parallelogram, 32 miles from E. to W., and 28 from N. to S., area 896 square miles. Extending in latitude from 41° 37′ to 42° N., and in longitude from 2° 3′ to 2° 43′ W. from W. C. Declivity to the southward. Alleghany river forms for a few miles the northeastern boundary, and thence entering, winds over this county into Verango in a southwestern direction, receiving at the borough of Warren the Conewango, a considerable tributary from the northwards, and at the Great Bend, five miles below Warren, Brokenstraw, a large creek comes in from the westward. Surface broken, and though yet thinly populated, much of its soil is excellent. Chief town Warren. Population in 1820, 1976, in 1830, 4766.

WARREN, county of, North Carolina, bounded N.E. by Roanoke river, separating it from Northampton, E. by Halifax, S. and S.W. by Franklin, W. by Granville, and N. by Mecklenburg county, of Virginia. Length 23, mean width 17, area 391 square miles. Extending in latitude from 36° 7′ to 36° 32′ N., and in longitude from 0° 56′ to 1° 21′ W. from W. C. This county is a table land. A little more than one-third declines to the northward, and is drained into the Roanoke, the southern slip of the valley, which is here only about eight miles wide. Beyond this narrow inclined plane rises the extreme sources of Fishing Creek, branch of Tar river, draining the central and southern part of Warren, and flowing southeastward until between Halifax and Nash counties. Soil of Warren generally good. Chief town, Warren Town. Population in 1820, 11,158.

WARREN, county of, Georgia, bounded N.E. and E. by Columbia, S.E. and S. by Jefferson, by Great Ogechee river separating it from Washington S.W., and Hancock W., and by Wilkes N. Extending in latitude from 33° 7′ to 33° 34′, and in longitude from 5° 26′ to 5° 52′ W. from W. C. Length 28, mean width 20, and area 560 square miles. Declivity of the southern and western part to the southeastward, and drained by Great Ogechee and Brier creek; the northern part slopes towards the N.E., and is drained by some branches of Little river into Savannah river. Chief town is Warren Town. Population in 1820, 10,630, and in 1830, 10,946.

WARREN, county of, Tennessee, bounded by Franklin S., Bedford S.W., Rutherford W., Wilson N.W., Smith N., White N.E. and E., and Cumberland mountain separating it from Bledsoe S.E. Greatest length 48 miles from the southern to the northern angle, mean breadth 20, and area 960 square miles. Extending in latitude from 35° 28′ to 36° 6′, and in longitude from 8° 19′ to 9° 4′ W. from W. C. Declivity N.E., and commensurate with the western and largest sections of the valley of Caney Fork river. Chief town M'Minville. Population in 1820, 10,348, and in 1830, 15,210.

WARREN, county of, Mississippi, bounded N. by Washington, N.E. by Yazoo county, E. by Big Black river separating it from Hind, S.E. and S. by Big Black river separating it from Claiborne, and W. by the Mississippi river separating it from Concordia parish in Louisiana. Length 40 miles, mean width 15, and area 600 square miles. Extending in latitude from 32° 3′ to 32° 35′, and in longitude from 13° 42′ to 14° 13′ W. from W. C. The Mississippi river bounding this county on the westward receives the Yazoo and Big Black rivers from the N.E.; the general declivity is therefore to the S.W. The eastern part is broken into hills, which in one or two places reach the Mississippi, forming clay cliffs. Along that great river, however, the bottoms are liable to submersion; but over the whole county, where the soil is sufficiently elevated to admit cultivation, it is highly fertile. Principal staple, cotton. Chief towns Vicksburg and Warren Town. Population in 1820, 2693, and in 1830, 7861.

WARREN, county of, Kentucky, bounded by Edmonson N., Barren E., Allen S.E., Simpson S., Logan W., and Butler N.W. Length from E. to W. 36, mean width 17, and area 612 square miles. Extending in latitude from 36° 50′ to 37° 11′ N., and in longitude from 9° 2′ to 9° 38′ W. from W. C. Declivity N.N.W. and traversed in that direction by Big Barren river, which unites with Green river at the extreme northwestern angle of the county. Chief town, Bowling Green. Population in 1820, 11,776, and in 1830, 10,947. This county was divided between 1820 and 1830.

WARREN, county of, Ohio, bounded S. by Clermont. S.W. by Hamilton, Butler W., Montgomery N.W., Greene N.E., and Clinton E. Length 24, mean width 20, and area 480 square miles. Extending in latitude from 39° 14′ to 39° 37′, and in longitude from 6° 55′ to 7° 22′ W. from W. C. The Miami river and canal crosses the northwestern angle of this county, whilst the central parts are traversed by Little Miami. The course of both rivers, and the slope of the county being to the southeastward. Surface rolling and soil excellent. Besides at Lebanon the county seat there were in 1830 post-offices at Deerfieldsville, Edwardsville, Franklin, Hopkinsville, Kirkwood, Red Lion, Ridgeville, Rochester, Springboro', Twenty Mile Stand, and Waynesville. Lebanon, post village and seat of justice for this county, is situated near the centre of the county, 31 miles N.E. from Cincinnati, and by post-road 83 miles S.W. by W. from Columbus. N. latitude 39° 25′, longitude 7° 12′ W. from W. C.

WARREN, county of, Indiana, bounded by the Indian country N.W., Tippacanoe county N.E., Wabash river separating it from Fountain S.E., Vermilion county S.W., and Vermilion county of Illinois, W. Greatest length, as laid down by Tanner, 26, mean breadth 18, and area 468 square miles. Extending in latitude from 40° 10′ to 40° 30′ N., and in longitude from 10° 6′ to 10° 40′ W. from W. C. The slope of this county is to the S.E., towards the Wabash. Williamsport, the county seat, lies about 30 miles to the N.W. by W. from Columbus.

WARREN, one of the western counties of Illinois, bounded by Mercer N., Knox E., Fulton S.E., Macdonough S., Hancock S.W., and Mississippi river W. This county was formed out of a part of the soldier's bounty lands, between the Illinois and Mississippi rivers, and similar to the adjacent counties, the outlines are agreeable to the cardinal points. Breadth from south to north 32 miles, mean breadth 30, and area 960 square miles. Extending in latitude from 40° 37′ to 41° 4′ N., and in longitude from 13° 26′ to 14° 6′ W. from W. C.

WARREN, county of, Illinois, extends from the Mississippi river over a narrow acclivity, and into the valley of Spoon river, branch of Illinois river. The southeastern part is drained by Swan creek, branches into Spoon river, but the greater part of the county has a western declivity towards the Mississippi.

By a note annexed to its name on the post-office list of 1831, it then, Oct. 1830, contained no post-office. The centre, as the outlines are delineated on Tanner's Map, is about 160 miles northwestward from Vandalia.

WARREN, post village and seat of justice, Trumbull county, Ohio, is situated on the Mahoning branch of Big Beaver river, 70 miles N.W. from Pittsburgh, 70 N. from Steubenville, and by post road 157 miles N.E. by E. from Columbus, and 297 miles N.W. by W. from W. C. N. latitude 41° 17′, longitude 3° 50′ W. from W. C. It is a thriving village. Population about 500. Darby.

WARREN, Joseph, a major-general in the American army, was born in Roxbury, Massachusetts, in 1740, and was graduated at Harvard college in 1759. Directing his attention to medical studies, he in a few years became one of the most eminent physicians in Boston. But he lived at a period when greater objects claimed his attention, than those which related particularly to his profession. His country needed his efforts, and his zeal and courage would not permit him to shrink from any labours or dangers. His eloquence, and his talents as a writer, were displayed on many occasions, from the year in which the stamp act was passed, to the commencement of the war. He was a bold politician. While many were wavering with regard to the measures which should be adopted, he contended that every kind of taxation, whether external or internal, was tyranny, and ought immediately to be resisted; and he believed that America was able to withstand any force that could be sent against her. From the year 1768, he was a principal member of a secret meeting or caucus in Boston, which had great influence on the concerns of the country. With all his boldness, and decision, and zeal, he was circumspect and wise. In this assembly, the plans of defence were matured. After the destruction of the tea, it was no longer kept secret. He was twice chosen the public orator of the town on the anniversary of the massacre, and his orations breathe the energy of a great and daring mind. It was he who, on the evening before the battle of Lexington, obtained information of the intended expedition against Concord, and at ten o'clock at night dispatched an express to Messrs. Hancock and Adams, who were at Lexington, to warn them of their danger. He himself on the next day, the memorable 19th of April, was very active. It is said in General Heath's memoirs, that a ball took off part of his ear lock. In the confused state of the army, which soon assembled at Cambridge, he had vast influence in preserving order among the troops. After the departure of Hancock to Congress, he was chosen president of the provincial congress in his place. Four days previously to the battle of Bunker's or Breed's Hill, he received his commission of major-general. When the intrenchments were made upon the fatal spot, to encourage the men within the lines, he went down from Cambridge and joined them as a volunteer, on the eventful day of the battle, June 17th. Just as the retreat commenced, a ball struck him on the head, and he died in the trenches, aged 35 years. He was the first victim of rank that fell in the struggle with Great Britain. In the spring of 1776 his bones were taken up and entombed in Boston, on which occasion, as he had been grand master of the Free Masons in America, a brother mason, and an eloquent orator, pronounced a funeral eulogy. With zeal in the cause of liberty which blazed, Dr. Warren was yet judicious in counsel, and candid and generous towards those who had different sentiments respecting the controversy. His mind was vigorous, his disposition humane, and his manners affable and engaging. In his integrity and patriotism entire confidence was placed. To the most undaunted bravery he added the virtues of domestic life, the eloquence of an accomplished orator, and the wisdom of an able statesman. He published an oration in 1772, and another in 1775, commemorative of the 5th of March, 1770.—*Allen's Biog. Dict.*

WARRICK, one of the southern counties of Indiana, bounded by Vanderberg W., Gibson N.W., Pike N., Dubois N.E., Spencer E. and S.E., and Ohio river separating it from Henderson county, Kentucky, S. Length 25, mean breadth 13, and area 325 square miles. Extending in latitude from 37° 54′ to 38° 15′, and in longitude from 10° 4′ to 10° 33′. The northern boundary of this county is on the table land between the vallies of Ohio and that of the Patoka branch of Wabash, but the much greater part of the surface slopes southwardly towards the Ohio. The surface is generally hilly, but the soil productive. It is drained by the branches of Big Pigeon, Cypress, and Little Pigeon creeks.

In the post-office list of 1831, there are named under the head of this county, two offices, one at Boonesville, the seat of justice, and the other at Newburgh.

Booneville, or Boonesville, the seat of justice, is situated near the centre of Warrick, 19 miles N.E. by E. from Evansville, on Ohio river, and by post road, 187 miles S.W. from Indianapolis, and 712 miles a little S. of W. from W. C. North latitude 38° 5′, and longitude 10° 18′ W. DARBY.

WARRINGTON, a large manufacturing town of England in Lancashire, is situated on the north bank of the Mersey, which is crossed by a stone bridge. It consists of four principal streets, some of which are inconveniently narrow, while others are spacious and contain some handsome buildings. The parish church is an ancient structure, containing numerous monuments. There is likewise there a chapel of ease, erected in 1760, a chapel for the suburb across the bridge, and meeting houses for catholics, presbyterians, anabaptists, methodists, and quakers. The free-school is well endowed, and there is an academy principally commercial, and a good charity school for children of both sexes. The chief trade of Warrington consists in the manufacture and sale of sail-cloths, which are composed chiefly of hemp and flax mixed, while another kind is made of flax alone. Some cottons, table-linen, coarse linens and checks are made in the town and its vicinity. The other manufactures of the place are fringes, glass and marble, and there is an iron foundry and a brewery. The flax and hemp for the sail-cloth manufactory is principally brought from Russia to Liverpool. The Mersey admits vessels of from 70 to 80 tons to Bank Quay, a little below the town, where there are warehouses, cranes, &c. The spring tides rise to the height of 9 feet at Warrington bridge. In 1821 the population of the township was 2748 houses, 2929 families, 2637 do. engaged in trade, and the total number of inhabitants 13,570.

WARSAW, the capital of the kingdom of Poland, is agreeably situated on the left bank of the Vistula, which is here about the size of the Thames at London. Including the suburbs, the town is between three and four miles long, and its breadth between two and three, but in this area are included many gardens. It is divided into the old and new town, and it has four suburbs, one of which, called Praga, is on the right bank of the river. The old town is occupied with one principal street and a few smaller ones, consisting of a number of miserably built houses. It contains the town-hall, the church of St. John, and the *ci-devant* church of the Jesuits. The new town stretches along the banks of the river for nearly three miles. The principal building is the palace of the kings of Saxony, now the residence of the viceroy. The castle of Warsaw is situated near the river, and is a large quadrangular building, in which the diet and senate hold their meetings. The new town contains several churches and other public buildings. The other public buildings not mentioned are the Blue Palace, the Lutheran church, which cost 40,000 ducats, the cathedral of St. John, the theatre, the arsenal, the mint, the great hospital, the barracks, the palace of Krazinsky (the finest public building in Warsaw), the palace of Czartorysky, Lazinsky, Salkowsky, Branichi, Radzivil, Bellinsk, Bruhl, &c. the palace of Sigismond II., the bridge over the Vistula, the observatory, and the pyramid in honour of the servant who was killed on the 3d November 1771, in the defence of Stanislaus. In 1794, the suburb of Praga was nearly destroyed by the Russians, but it has been lately rebuilt on a handsome plan.

About the end of 1816 an university was established at Warsaw like those of Germany. The other establishments are a military academy, a college for the sons of the catholic nobility, a lyceum, and schools for surgery and drawing. There is also here a public library, a cabinet of coins and medals, a society for the sciences, and another for natural history and agriculture.

The principal manufactures of Warsaw are woollen fabrics, tobacco, soap, carpets, gold and silver wire, carriages and harness. The trade is greatly facilitated by the Vistula, which is navigable to a great extent in both directions. In midsummer, when its channel is full, 100 boats or barges laden with corn, spirits and wine, are daily sent down its stream.

The promenades of Warsaw are the garden of the Saxon palace; the Favourite, and the gardens of Szewask, Krasinsky, and Poniatowsky, and the Grounds of the Chateau of Ujazow. At the Chateau of Willanow, in the vicinity, is shown the bed in which the great Sobieski died. This chateau was the residence of that sovereign, and is still admired for its fine gardens and statues. The bridge across the Vistula was a floating one 1500 feet long, but is probably now replaced by one of stone. Population 100,000. East Long. 20° 2′ 45″ and North Lat. 52° 14′ 8″. See POLAND, BRITAIN, and FRANCE.

WARWICK, county of Virginia, bounded by James City county N.W., York N. and N.E., Elizabeth City county E., and James river S. Length 18 miles, mean breadth 5, and area 90 square miles. Extending in latitude from 37° 3′ to 37° 13′, and in longitude from 0° 22′ to 0° 38′ E. of W. C. It occupies a part of the narrow peninsula between James and York rivers, and slopes southward towards the former. By the post list of 1830, it contained one office at the court house. Population in 1820, 1608, and in 1830, 1570.

DARBY.

WARWICK, a town of England, and the capital of Warwickshire, is situated on a rocky hill, on the banks of the Avon, which is crossed by an elegant stone bridge of one arch. The streets meet near the centre of the town, and are regular and well built. The principal one is remarkably neat, and is intersected by another running nearly north and south. The principal street is terminated by a venerable looking chapel. The court-house or town-hall stands near the centre of the south side of this street, and is a handsome stone building, in which the county assizes, &c. are held. There were formerly six parish churches, but there are now only two, the principal of which is dedicated to St. Mary. It is a noble Gothic edifice, and contains several handsome monuments of the Earls of Warwick, and one of the unfortunate Earl of Essex. The burying-ground of the Warwick family is a stately chapel adjoining the church. At the west end of the church, which was finished in 1709, is a square tower 130 feet high. The body of the church is 185 feet long, and 66 broad, and the cross aisle 106. The remains of the ancient church still adorn the interior, the choir having escaped the flames which destroyed the old church in 1694. There are here chapels for the presbyterians, methodists, baptists, independents, and quakers. The county-hall is a spacious and elegant building, with a chaste front. The market-house is a substantial stone building with piazzas. The county jail, close to the county-hall, is every way suited for its object, both in its external aspect and interior accommodation. The bridewell is likewise well and judiciously constructed.

One of the principal ornaments of the town is Warwick castle, which is situated on a solid rock, on the north bank of the Avon, and nearly 100 feet above its bed. The entrance to the castle is by a winding path cut through the solid rock, and the observer is delighted with a successive display of lofty and massive towers breaking upon his view. On the left hand is Cæsar's tower, and on the right Gay's tower, which is above 100 feet high. The moat is crossed by a stone bridge, and the entrance is through double towers. The inhabited suite of apartments extends 330 feet in length, and they are finished with much taste, and adorned with many choice paintings. The face of the building to the river is irregular, but has a grand effect rising above the wall and rock on which it rests.

The principal manufactures of Warwick consist in cotton spinning, wool spinning, and malt making, and the trade of the place is greatly facilitated by the Warwick and Birmingham canal. Warwick sends two members to parliament. In September 1697, Warwick was nearly destroyed by fire, but by means of £11,000 granted by parliament, and £1000 by Queen Anne, it was handsomely rebuilt.

The population of the burgh in 1821 was 4523 inhabited houses, 1760 families, 1026 do. in trade, and the total population 8235.

WARWICKSHIRE, one of the inland counties of England, extends about 48 miles from N. to S., and is about 32 miles broad. Its area is 902 square miles, or 577,280 statute acres. The rent of land is £645,137, beside the amount of tithe, which is £26,122. The annual value of a square mile is £299. The county is divided into four hundreds, exclusive of the city of Coventry, which, with its liberties, occupies 18,000 acres.

The greater part of Warwickshire is that of a level district, with few and gentle undulations. Hence it is well enclosed, and exhibits but little waste land. The pasture land is calculated at 300,000 acres, 100,000 of which is cut for hay. The soil is various, and suited to different systems of agriculture. The usual crops are wheat and barley, oats, peas, beans, and tares. Turnips are extensively and skilfully cultivated. Rye, potatoes, and flax, are also raised. Various kinds of stock are reared on the pasture lands, but the long-horned cow is the most common breed. The ancient Warwickshire sheep of the large polled kind have been judiciously crossed with the Leicester breed, and an admirable variety has been the result.

The most elevated points of land in this county are at Corley, and in the neighbourhood of Packington. From this ridge the streams run into the Avon on one side, and thence into the Bristol Channel. On the other side they flow into the Blythe, Tame, Trent, and Humber. The principal streams are the Avon, the Tame, the Leam, the Stour, the Rea, the Arrow, the Anker, the Alne, the Swift, the Blythe, the Dove, and the Cole. The Avon alone is navigable for barges from Stratford to its junction with the Severn.

The principal minerals in Warwickshire are coal, limestone, ironstone, freestone, blue flagstone, marl, and blue clay. The best coal, which is a seam three or four feet thick, is at Bedworth, an ironstone vein was previously wrought near to Oldbury. The chief medicinal springs are those of Leamington Priors, and Newenham Regis. The former contains neutral and sulphureous salts, with carbonate of iron, and are much resorted to for visceral obstructions, and cuticular affections. The latter are a weak chalybeate, and are in less request than they once were.

Warwickshire is celebrated for its manufactures. Those of Birmingham, Warwick, and Coventry, have already been described under these articles, and in our article ENGLAND. Calico-printing is carried on extensively at Tamworth. Horn-combs of all kinds are made at Kenilworth. At Alcester about 900 persons are employed in making needles, and in other parts of the county there are considerable manufactories for flax, and a great deal of linen yarn spun.

The trade of this county is greatly facilitated by the following canals: the Grand Junction, the Birmingham Old Canal, the Birmingham and Fazeley, the Warwick and Birmingham, the Worcester and Birmingham, the Coventry, the Warwick and Napton, the Stratford, and the Ashby-de-la-Zouch Canal, all of which are fully described in our article NAVIGATION, *Inland*.

Among the antiquities of this county may be enumerated the Roman Roads of *Walling Street*, which divides the county from Leicestershire, the *Fossnay*, which is supposed to have been formed in the third consulship of Hadrian, the *Icknield* or *Ryknild Street*, and the minor road of *Ridgeway*, which borders on Warwickshire. The Roman stations in and near the county are *Alcester* and *Tripontium* at Lilburn. The principal Roman camps are on the Foss-way, and on the Avon, where Ostorius constructed a chain of minor fortifications. Roman tumuli and coins are common. Among the more modern antiquities may be enumerated Kenilworth Castle, now in a dilapidated condition; Maxtoke Castle, a huge pile of building; the Cistertian Convent of Comb Abbey; the schoolhouse at Rugby, and the house at Stratford which gave birth to Shakspeare.

The principal towns of the county, with their population in 1821, are

	Population.	Houses.
Birmingham . .	106,722	21,487
Coventry, exclusive of the county of Coventry, . .	21,242	4,277
Warwick, . . .	8,235	1,706
Nuneaton, town and parish,	6,610	1,492
Sutton Coldfield, town and parish,	3,466	677
Atherstone township, .	3,434	718
Stratford, . . .	3,069	590

The population of the county in 1821 is as follows:

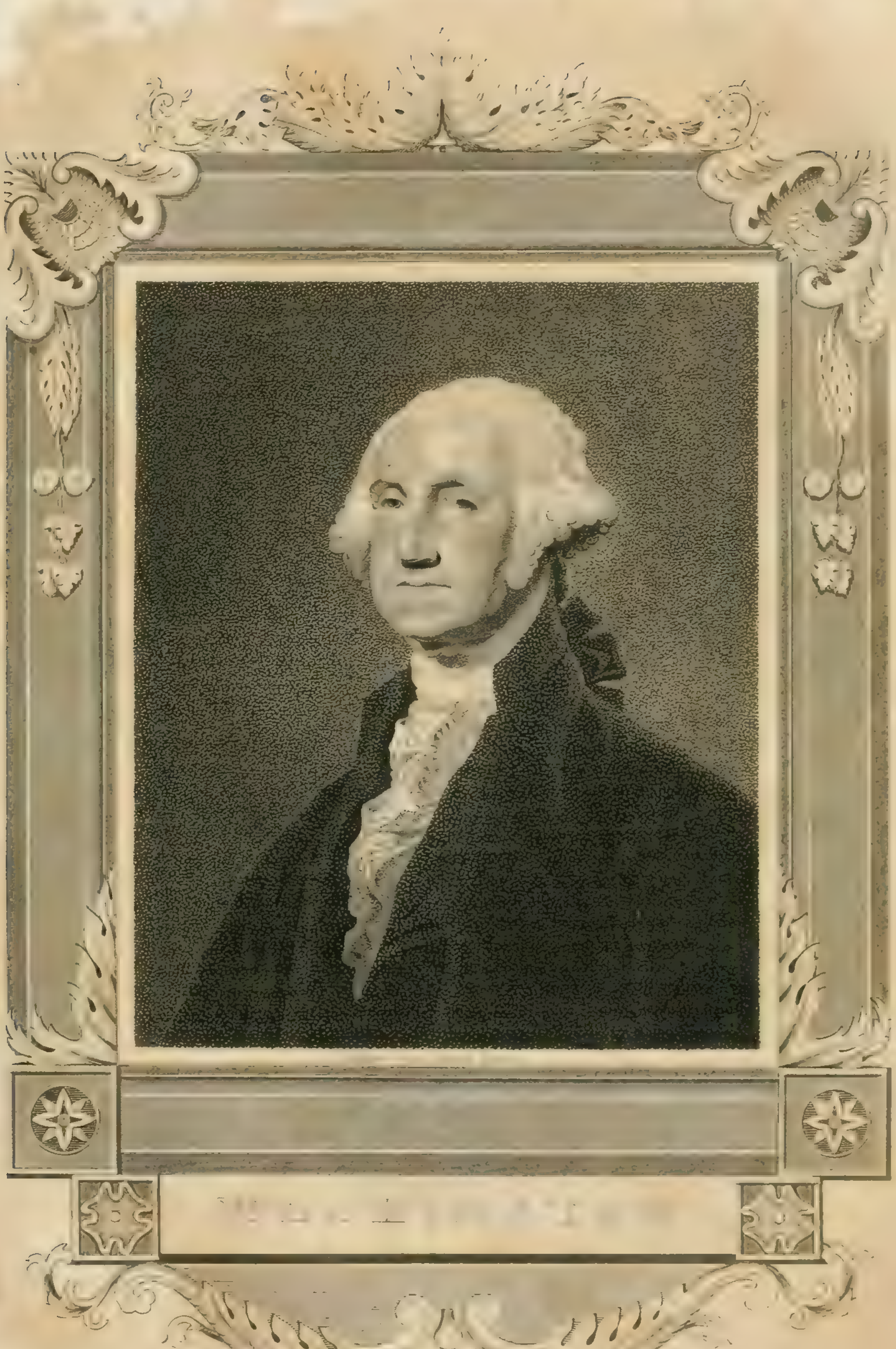
Inhabited houses, . . .	55,082
Families, ...	60,123
Ditto employed in agriculture, . .	16,779
Ditto ditto trade . .	39,187
Population in 1821 . . .	274,392
Ditto in 1811 . . .	228,735
Increase since 1811, - .	45,657

See the *Beauties of England and Wales*, Vol. XV. and Dugdale's *History and Antiquities of Warwickshire*.

WASHINGTON, GEORGE, was born in the year 1732, on the 22d of February; as every American learns from the annual jubilee of his country's gratitude. A plantation called Wakefield, in Westmoreland county, Virginia, was the place rendered illustrious by his nativity. The mansion house was then situated on Pope's creek, about half a mile from the Potomac; but it has since fallen into ruins, and there is no trace of its former existence but in the records of him whose memory can never die.

The family of the subject of this memoir traces its descent from John Washington, who emigrated from England and settled upon the estate of Wakefield in the year 1657. His grandson, Augustine, was twice married. By his first union he had two sons, Lawrence and Augustine; by his second intermarriage with Miss Mary Ball, he left five children, the eldest of whom was George Washington, whose life and career will be briefly sketched in the present article.

The care and education of Washington devolved upon a fond and intelligent mother, in consequence of the death of his other parent while he was yet in early childhood. His studies were directed to objects of strict and substantial utility, according to



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the ordinary custom and limited opportunities of American gentlemen at that early period; but the formation of his character upon the solid foundation of virtue and religion, was the object of an interest that knew no intermission; and the success of the result is now deeply graven on the fairest page of the world's whole history.

The bent of his mind towards the profession of arms exhibited itself so strongly before his fifteenth year, that a midshipman's warrant was then obtained for him through the influence of friends. To this project insuperable obstacles were opposed by maternal tenderness, and three years afterwards he appears to have been employed as a public surveyor, by Lord Fairfax, proprietor of the Northern Neck of Virginia. In his nineteenth year he received a commission appointing him an adjutant-general of the province, with the rank of major, and from that period his military career was no longer to be restrained or impeded.

The movements of the French, which began at this period to unveil their vast design of connecting Canada and Louisiana by a regular chain of fortified posts, attracted the jealous notice of Governor Dinwiddie, and deeply excited the apprehensions of the inhabitants of the provinces. The responsible duty of visiting the French commander, and of conveying the remonstrance against his proceedings, was consigned to Major Washington, then barely twenty-one years of age; but the mission was executed with a prudence, courage, and ability, that would have honoured the maturest judgment, and which greatly elevated the character of the young envoy among his countrymen. The journey was undertaken at the most dangerous season of the year, and exposed to such perils from floods and concealed enemies, as could scarcely be conceived at the present day by the peaceful inhabitants of those flourishing regions. Washington's journal, which was regularly kept for the information of the governor, gave brilliant promise of his qualities for public service: his military observations on the country through which he passed, exhibited sagacity and knowledge far beyond his years and limited experience, and were afterwards of eminent service in the difficult wars waged with the French and their Indian allies. It was he who first invited attention to the commanding position now occupied by the city of Pittsburgh: though the enemy afterwards anticipated the provincials, by the erection of the famous Fort du Quesne, for so many years the source of all evil to the British colonies.

The continued invasions of the French rendered it necessary to make active preparations for defence, and a regiment of three hundred men was therefore raised, under the authority of the Virginian assembly. Of this force, the command was conferred upon Colonel Joshua Fry, and the Lieutenant-colonelcy given to Washington. No regular declaration of war had yet passed between England and France, but the troops of both parties already treated each other as enemies, whenever opportunities of collision were presented. In April 1754, the lieutenant-colonel advanced with two companies to the Great Meadows in the Alleghany mountains, for the double purpose of protecting the frontier and watching the progress of the French. He there received notice from a friendly Indian, called the Half King, of some recent acts of aggression, and of the proximity of a French detachment, which then lay encamped and concealed in the neighbourhood. As no doubt could possibly exist in relation to their hostile intentions, Washington determined at once to anticipate the movement, knowing that in war none are so open to surprise as those who meditate the same upon their adversaries.

He marched the same night towards the French camp, and his measures were so well concerted, that after a short contest the whole party (with the exception of one man) were either taken or killed: among the latter was M. de Jumonville, the commander. This skirmish attracted great attention at the time, because the pretended murder of his officer was one of the main complaints of the king of France at the declaration of war; but it is now chiefly remarkable as the first martial exploit of one who afterwards filled so large a space in the history of modern warfare.

The death of Colonel Fry shortly after these transactions, devolved the command of the Virginian regiment upon Washington; and he was farther strengthened by the junction of two additional companies of regulars. With this force he immediately marched to dislodge the enemy from Fort du Quesne; but learning on his advance that a body of eight hundred French and four hundred Indians were on their way to meet him, he was compelled to fall back upon his little post at the Great Meadows, called Fort Necessity. To this position he was very soon followed by Monsieur De Villiers, who commenced at once a warm and vigorous attack. An extremely gallant defence was made by the Americans, and when the superiority of the enemy at length rendered a capitulation necessary, Washington retired with all the honours of war for his garrison, and with the highest personal character for courage and conduct. The legislature of Virginia expressed the gratitude of the province in a public vote of thanks to the commander.

In the course of the following winter (1754-5) orders were transmitted from England, regulating the comparative ranks of regular and provincial officers. The general and field officers of the colonies were divested of all rank while serving with the same grades commissioned by the king; and company officers of equal rank were directed to give precedence to the regulars, without regard to seniority of date. Professional pride and dignified self respect were always among Washington's most marked characteristics. Notwithstanding his ardent devotion to a military life, he resolved at once to resign a station which he believed was no longer to be held without personal dishonour, and his commission was immediately returned into the hands of the governor of Virginia. He retired to Mount Vernon, a seat on the Potomac, which had descended to him from his eldest brother, lately deceased: and he there resided until a new call was made upon his services, in that name to whose appeal he was never deaf or wanting.

An army composed of two English regiments and some corps of provincials, raised for the purpose of striking a serious blow at the enemy, was placed under the orders of General Braddock, a brave soldier, but otherwise of unfounded reputation. The military talents and local knowledge of Washington were considered essential to the success of the expedition; and he was consequently invited to join it, with the rank of aid-de-camp to the commander.

Great delays occurred from the difficulty of obtaining wagons, which, according to the rules of European warfare, were deemed indispensable. It was long in vain that the experienced aid-de-camp advised the substitution of pack-horses; but at last the reason of his counsel became too strong for the prejudices of the *regular* commander, and Braddock marched for Fort Du Quesne, with the confident expectation of driving the French from their strong hold on the Ohio. Celerity was considered by Washington the secret of success; for the French force assembled to oppose them was known to be small, though there was reason to apprehend its immediate and formidable increase. Advice to this effect was urgently repeated to the general, but his council of war regularly overruled it as rash and contrary to established custom. When rapidity was at length determined upon, four days were occupied in advancing nineteen miles; and according to a letter written by the aid-de-camp, " they were halting to level every mole-hill, and to erect bridges over every brook." This ridiculous delay was unaccompanied by even ordinary caution. The army marched without advanced guards or scouts, and the whole force of French and Indians was embodied in their front, without the least suspicion, on the part of the English commander, of the approach of a single enemy. It was on the 9th of July 1755 that the British army was suddenly attacked on the Monongahela, and a battle was fought long memorable in the annals of the colonies.

Within a very short time after the commencement of the fight, from the advantageous position and deadly fire of the French, the whole duty of transmitting the general's orders devolved upon Washington, who was the only aid-de-camp alive and unwounded. Trying occasions, however, were those in which his remarkable qualities were best developed; and it was in the midst of the carnage and horrors of " Braddock's defeat," that men first began to prophesy the glorious career prepared for him in the wisdom of an all-seeing Providence. Two horses were shot under him, and his coat pierced by four balls, but he escaped without a wound. Five horses were also killed under General Braddock, and when at last that gallant but unfortunate commander fell mortally wounded, the whole British force fled outright, leaving the care of their general to Washington and two other individuals. The provincial troops bore the whole brunt of the day, and suffered dreadfully: in two companies, every officer but one was killed, including the very corporals. The regulars saved their lives by their disgraceful panic, but they never regained in the provinces that renown for military invincibility, which formed one of the strongest bands of colonial dependence.

The reputation of Washington, both for conduct and courage, was greatly increased by the campaign of the Monongahela: it was generally known among the troops, that his advice would have saved the army from defeat, and perhaps conduced to ultimate success, while his coolness in battle was the theme of universal panegyric. The legislature of Virginia, at this period of public distress, ordered a regiment of sixteen companies to be formed, and the command was immediately bestowed upon Colonel Washington, with the additional title of " commander in chief of all the forces raised or to be raised in the colony of Virginia." The power annexed of selecting all field officers, was an extraordinary exhibition of the confidence and respect with which he had already impressed his countrymen.

The duties of Washington's new station were arduous and responsible, without any of the corresponding gratifications. He was called upon to protect an extensive and exposed frontier, against the predatory incursions of an enemy subdivided into small parties, and formidable from their activity and skill in the warfare of the wilderness; while the forces of Virginia where wholly inadequate to the results expected from their harassed commander. It is needless to enter into the details of his history at this period, for they present little more than a series of laborious exertions for the welfare and discipline of his soldiers, mixed with constant remonstrances to the government of Virginia, which was not always well advised in its resolutions. In the way of active hostilities, the provincial troops had frequent skirmishes with the enemy, in all of which they exhibited the fruits of their strict training; but no conflict occurred of sufficient consequence to deserve special commemoration. At length, in 1758, Fort Du Quesne was captured without resistance by the advanced guard of General Forbes's expedition, commanded by Colonel Washington: and thenceforward the middle colonies were freed from the terrors of French and Indian hostility. Our hero (and surely no man was ever better entitled to the appellation), now felt himself at liberty to return to that enjoyment of private happiness, which had for some time been the object of his warmest aspirations; and he laid down his commission amid the general regret of his countrymen, who treated the resignation as a public loss. He shortly after was married to Mrs. Custis, a lady possessing personal merits more than equal to her extensive estates, and who contributed largely during the whole of her husband's after life, to his domestic quiet and felicity. He was not, however, entirely withdrawn from public duties, for about this period he took his seat in the General Assembly of Virginia, as a member for the county of Frederick.

The life of Washington is wholly identified with the service of his country—always tranquil while she remained at peace, and active only when her rights or territory were threatened with invasion.

We find no remarkable event in his history, until the commencement of the colonial difficulties with the mother empire, when he was among the first in the Virginia legislature to offer a firm resistance to the unconstitutional pretensions set up by parliament. When measures of defence were considered requisite, he was chosen to command the independent companies raised by his native province; and he was afterwards elected, in the year 1774, one of her representatives in the continental congress. He was appointed in this body, upon all committees relating to military preparations: but a moment soon approached pregnant with the most important consequences to Washington and to the world.

Bloody conflicts had taken place in the north, which in their results had excited the provincials to enthusiasm and revenge, while they inspired them with new confidence in their military efficiency. The spirit of insurrection spread through all the land, and the British, notwithstanding their sanguinary success at Bunker's Hill, were closely besieged in Boston by an overwhelming American force under General Ward. It now became imperiously necessary for Congress to settle some definite organization of their army, calculated to fix the floating confidence of the country at large; and the question of the selection of a proper commander was therefore one of engrossing interest to the assembled patriots. It was felt sensibly by the New England delegation, that in point of direct interest and aggression, the cause of the provincial hostilities had been hitherto entirely local. Their natural sagacity taught them that it was of material consequence to adopt some measure tending to strengthen the ties of union with the southern colonies: and they were disposed to acquiesce in any nomination of a general, which might contribute to render resistance universal. Then it was that a few words from John Adams determined the fate of America, and advanced the cause of liberty throughout the world. In an able and eloquent speech, he set forth the numerous and peculiar difficulties of the country and the army; and when all his hearers were deeply engrossed in the subject, and anxiously awaiting the remedy to be suggested, he nominated as commander of the forces, "a member of the house, George Washington of Virginia." On the 14th of June 1775, by an unanimous vote of the delegates of the provinces, the motion was adopted, and Washington was appointed "General and Commander-in-chief of the army of the United Colonies, and of all the forces now raised or to be raised by them, and of all others who shall voluntarily offer their service."

When this election was announced to the new generalissimo by the president of congress, he exhibited the modesty, patriotism, and disinterestedness which were ever the prominent characteristics of his life. He expressed the distress he felt from a diffidence in his abilities and military experience, but at the same time a firm determination was declared to exert every power for his country's service, and the success of her glorious cause. He declined any pecuniary reward for the duties to be rendered in his station; he expected no more than a mere indemnity for expenses actually incurred, of which his intention was to keep a regular and exact account. It was unanimously resolved, that "Congress would maintain, assist and adhere to him as the general and commander-in-chief of the forces raised for the maintenance and preservation of American liberty, with their lives and fortunes." Washington prepared at once for the execution of his high duties; and amid the general acclamations of all classes and sections of the country, he assumed the supreme command of the army then engaged in the siege of Boston.

The American force numbered fourteen thousand five hundred men, lying on both sides of Charles river, and scattered along an extensive line of at least twelve miles. The right was posted on the hills about Roxbury, extending towards Dorchester, and was commanded by Major-general Ward: Washington fixed his head quarters, and personally directed the centre and reserve: Major-general Lee lay with the left wing near the river Mystic.

The garrison of Boston exceeded twenty regiments. Bunker's Hill was the post fortified and held by the main body under General Sir William Howe—another division was intrenched on Roxbury neck—and their position was further strengthened by a battery on Cop's hill, three floating batteries in Mystic river, and a twenty gun ship.

The American forces were very far from possessing an efficiency by any means equal to their numbers. The commander-in-chief found "the materials for a good army—a great number of men, able bodied, active, zealous in the cause, and of unquestionable courage"—but in all military requisites he soon perceived radical and almost irremediable deficiencies. A few days after his arrival, it was discovered that the whole quantity of ammunition on hand could barely supply nine rounds to each man: and in this situation, an army without bayonets, remained for two weeks, when a small supply of powder was received from Elizabeth Town in New Jersey. A siege was to be conducted without engineers, and with a scarcity of working tools: and the rigours of winter were to be supported by troops without tents or sufficient clothing.

But there were other difficulties lying at the root of military government and organization, greater and more important even than these. Each province had levied its own quota of troops, according to regulations established by itself: and hence arose evils, of which the least was a dangerous want of uniformity. As an example, the soldiers of the Massachusetts line lived on a footing of perfect equality with platoon officers elected by themselves; and this sort of sociability was a greater recommendation to promotion than individual fitness. The creation of discipline in an army is, even under the most favourable circumstances, a work of time and attention: the embarrassments of a general may therefore be conceived, when placed at the head of such a host, all of whom were to be discharged and replaced by new levies before the end of the succeeding month of December. An overruling Providence had provided the only instrument that was fitted for the time and the occasion. Washington applied himself indefatigably to the subduing of the difficulties around him. He organized his army into brigades and divisions, and proceeded to drill them with untiring perseverance. Through his recommendation, Congress was induced to appoint a paymaster, quartermaster-general, and other regular staff of a military establishment.

Towards the close of the season, the whole American army, officers and soldiers, was to be disbanded and renewed in the face of their beleaguered enemy. In the beginning of January, owing to discharges and unavoidable furloughs, the total of the forces scarcely exceeded nine thousand men, though the number was afterwards increased to about fourteen thousand, when congress, at the instance of their general, offered a bounty upon enlistment. It was with deep mortification that the commander-in-chief felt himself compelled to submit to a state of comparative inactivity, by the utter inadequacy of his means to the purposes of offensive warfare: but he never neglected to make advances upon the enemy, when a favourable opportunity was presented. Ploughed Hill, Cobble's Hill, and Lechmere's Point were successively occupied by the Americans: and the floating batteries were driven from their moorings by the cannonade to which they became exposed.

About the end of February 1776, Washington resolved by a decisive movement to bring the siege to some determinate conclusion. For this purpose, during the night, he occupied the commanding position of Dorchester heights with a strong force; and the besiegers were thus enabled to annoy the fleet in the harbour, and the army in the city of Boston itself. The British commander had now the alternative of dislodging the Americans by main force from their new post, or of wholly evacuating the place. A plan to effect the former purpose was frustrated by a violent tempest, which scattered the vessels containing Lord Percy's chosen division: and evacuation was rendered inevitable by the increased strength of the American intrenchments. On the 17th of March, the retreat of the enemy's legions to their ships was witnessed by the undisciplined array of the besiegers; and shortly afterwards the British fleet bent its sails and was borne from the neighbourhood of the capital of New England. The glorious conquest thus achieved was hailed with joyful triumph throughout the colonies. A golden medal, commemorative of the occasion was struck by order of Congress, and a vote of thanks was passed to Washington and the army, "for their wise and spirited conduct in the siege and acquisition of Boston."

In anticipation of the early retreat of the besieged, and the probability of a hostile attempt upon New York, the commander-in-chief had already detached a strong force for the protection of that important city. The main American army was now marched southward, and reached New York on the 14th of April: batteries were erected, and every exertion used to strengthen the defence of the place. In consequence of the earnest representations of Washington, Congress was induced to vote a reinforcement of thirteen thousand eight hundred militia, and to form a flying camp for the purpose of repelling any attempt of the enemy to land on the Jersey shore; but it was long before other deficiencies, equally important, could be remedied, or even partially supplied. The sinews of war are not to be created by the prudence and experience of a commander; comforts and necessaries for an army require something more than vigilance and courage; and the fatal errors of short enlistments and incomplete regiments, could only be arrested by time and misfortune.

Upon the evacuation of Boston, the British army retired to Halifax, at which place reinforcements from England were expected by Sir William Howe. He at length, however, re-embarked his forces and sailed to Staten Island, where a landing was effected on the 3d and 4th of July. Ample supplies were immediately procured, owing to the extreme disaffection of a great portion of the inhabitants of those parts; and the intrigues and popularity of Governor Tryon even collected a considerable force of loyalists, as they were termed, who were embodied under his own immediate command. The machinations of these concealed foes severely tested the vigilance of the American leader. Among other things, a conspiracy was discovered in the city of New York, headed by its mayor, to excite an insurrection upon the landing of the British, and to deliver into their hands the post and the person of the general. The design was fortunately defeated, and some of the most guilty brought to condign punishment; but the spirit of disaffection still remained to cripple the progress of liberty, and to assist the movements of its more open adversaries.

Meanwhile the great change was advancing, which was to affect the whole character of the war, and to build the foundations of a new empire out of the massive materials rent from the crumbling structure of the old. The banners of the colonies had hitherto only been unfurled for the redress of tyrannical grievances inflicted by arbitrary acts of the British parliament, without impeachment of the sovereignty of George III.: national independence was an experiment too daring and uncompromising to meet with early and welcome acceptation. But the bitter animosities engendered by protracted warfare, had slowly undermined the kindly feelings of origin and kindred. It was generally acknowledged that no reconciliation with the mother-country could be cordial or lasting—no greater or more dangerous struggle was necessary, even if independence were to be the meed of triumph—and the tempting advantages of self-government, compared with a distant controul exercised for the commercial benefit of the rulers alone, gradually led the minds of men to this great and important contemplation. The progress of popular feeling was regularly exhibited in the successive resolutions of congress; the measures adopted became more and more vigorous, and the tone of the public declarations rapidly increased in boldness and determination. At length, on the 7th of June, independence was directly moved by Richard Henry Lee, seconded by John Adams; and the committee to whom it was referred, reported a resolution "that these United Colonies are, and of right ought to be, free and independent states; and that all political connexion between them and the state of Great Britain is and ought to be totally dissolved." Some necessary delays took place after this report, but on the 4th of July, when all was matured, the glorious declaration went forth, which claimed for the United States of America that stand among the nations of the earth, which God and nature had assigned them. The army hailed the new epoch with all the ardour of military enthusiasm, and the friends of liberty rejoiced that their holy struggle was no longer to be characterized as the war of subjects with their acknowledged king.

The two armies were now again fairly arrayed, and the fortunes of the new republic were to be weighed in the scales of war. Lord Howe, and his brother Sir William, had been invested with the royal commission to pacify the colonies, including very large powers of pardon and exemption; their first effort was, therefore, an attempt at conciliation. Some correspondence that took place with the American leader, strongly exhibited the elevated tone of character for which Washington was ever distinguished. A flag of truce addressed to "George Washington, Esq." was sent back without an audience, and a like result attended other communications of the same nature. The commander-in-chief declined holding any intercourse, when the public character was not acknowledged which alone made him the organ of correspondence. To a proud exhibition of the authority of the British commissioners, he replied that Lord Howe and Sir William were empowered to grant pardons, but that none were needed by those who had committed no fault: the American nation was only defending its indubitable rights. It was evident that no arbiter remained but the force of arms, and both parties prepared themselves for immediate conflict.

The English army, swelled by powerful reinforcements, now numbered twenty-four thousand men in its array, perfectly equipped, and veterans in the discipline of war; an immense fleet protected its movements, and insured communications and supplies. Ten thousand men, enfeebled by long exposure, and the consequent maladies of new soldiers, constituted the whole array of the Americans at the landing of Sir William Howe: through the extraordinary and indefatigable exertions of the commander-in-chief, this force was increased to twenty-seven thousand before the middle of August, though one-fourth were sick, and almost all the levies raw and undisciplined. The main body lay on York island; a strong force under Major-general Sullivan was posted on Long Island, and Governor's Island and Powles Hook were occupied by small detachments. The mind of Washington was filled with the deepest anxiety: he plainly saw all the hazards to which he was exposed, and he announced them to Congress: but at the same time he expressed his stern confidence of forcing the enemy to buy dearly any advantage they might obtain. In the energetic proclamations addressed to the army, he exhorted them "to animate and encourage each other, and show the whole world that a freeman contending for liberty, on his own ground, is superior to any slavish mercenary on earth."

The principal position of the American army on Long Island was at the village of Brooklyn, where a camp had been intrenched, and was held by Putnam with a strong detachment: the troops beyond these lines were more exposed, though the prudence of the general-in-chief had foreseen all dangers, and provided for every casualty. The British having landed on the island, attacked these outposts vigorously on the 26th of August. Unfortunately, owing to very blameable neglect of duty in those who were charged with the execution of the precautionary measures inculcated in Washington's order, Sir Henry Clinton was enabled to surprise an important pass, and to turn General Sullivan's position, while Generals Grant and De Heister occupied his attention with a brisk cannonade. The consequences were extremely disastrous; the divisions most exposed to the enemy were compelled to take refuge within the lines, after suffering severely in killed, wounded, and prisoners, including among the last the commander, Sullivan himself, and Brigadiers Lord Stirling and Woodhull. Sir William Howe estimated the American loss at the exaggerated number of three thousand three hundred men, while his own was calculated at three hundred and sixty-seven. Washington's report, which stated his loss below one thousand, most probably included only the regular continental troops, without regard to the militia.

As soon as the commencement of the engagement was announced, Washington passed over to Brooklyn from York Island. His military eye immediately perceived the impossibility of retrieving the fortunes of the day; the forces already engaged were entirely too feeble to contend with the overwhelming superiority of the British general, and no reinforcements from the main army could have enabled the Americans to keep the field with a chance of success. Unwilling to attempt a movement which could only have produced a waste of human lives, while it staked the whole fortune of America on the hazard of a single die, he confined his exertions to the safe withdrawal of the troops within the fortified lines, and to preparations for a general retreat from the island, now rendered inevitable by circumstances. In the meantime he exhibited so imposing a front to the enemy, that Sir William Howe and his elated army were deterred from a bold and immediate attack, and their advances were conducted with all the cautious formalities of a regular siege.

On the night of the 28th, that celebrated retreat was effected, which gained for the American leader so distinguished a name among the warriors of the earth. With the triumphant array of the

British army in front, and a powerful fleet prepared to intercept him in the rear, Washington withdrew across a broad river his defeated forces, and all his military stores and artillery, except a small quantity of provisions, and some heavy guns. In the morning the rising sun displayed to the astonished Britons the last American divisions crossing the waters, and already far beyond the reach of annoyance or pursuit.

The American forces were now concentrated upon York Island; and the movements of the hostile army and fleet began plainly to indicate that there was no intention to leave them undisturbed. The great importance attached by Congress to the preservation of the city, was fully appreciated by the American commander; but when it became obvious that Sir William Howe's plan was to cut off all his communications by taking post in his rear, while the front was effectually guarded by the shipping, Washington's judgment was soon satisfied that no course could be prudent or advisable short of immediate evacuation. The daily advances of the British rendering the American position every day more critical, brought a large majority of the council of war to the same opinion; and New York was abandoned with a serious loss in heavy cannon and military stores. The American army fell back to the neighbourhood of Kingsbridge, where it strongly fortified itself; while Howe, after taking military possession of his important conquest, immediately moved in pursuit, and encamped in front of the intrenchments. The policy of Washington was now to renew the courage and increase the discipline of his troops by frequent skirmishes, without venturing on any considerable engagement; some severe contests accordingly took place, which produced honourable results, though not decisive of any very important consequence. General Howe, on the contrary, was bent upon bringing on a general action; and as his adversary became more enterprising in attack, he increased his circumspection in guarding every vulnerable point. The English army marched always in close column; its encampments were compact and guarded by artillery. When demonstrations upon the American rear, both by land and water, seriously endangered the connexion with the country, Washington retired towards the White Plains, where he again entered into intrenched lines, with the enemy in front.

Sir William Howe now made every preparation for storming the American camp, and on the 25th of October the British forces were drawn up for that purpose in line of battle. A hill on the American right, occupied by General M'Dougall, with sixteen hundred men, chiefly militia, was the first point of attack, and was assailed with great vigour. The regular troops from Maryland and New York, commanded by Smallwood and Reitzimer, disputed the ground with remarkable firmness and audacity, and it was not until after a loss on each side of between three and four hundred men, that the Americans retreated to the main body, and the British remained masters of the post. Washington continued in his intrenchments, fully prepared for the threatened assault; the English general, however, changed his plans, and now considered it advisable to wait for expected reinforcements under Lord Percy. Several days were spent in mutual observation, until these troops arrived; the American commander then retired to the heights of Newcastle, where his position was so strong as to induce General Howe to abandon his designs against the main army, and to direct his movements to other objects.

As soon as the British forces began slowly to retreat down the Hudson, Washington perceived their plan of operations. In his letters to congress, to the governor of New Jersey, and to General Greene, he expressed his firm conviction that the enemy meditated the investment of Fort Washington, and the invasion of the Jerseys; and he strongly recommended that the men and stores in the former post should not be exposed to unnecessary hazard. From a mistaken confidence in the strength of the fort, this counsel was neglected; and Sir William Howe, after carrying the outworks by assault, received the surrender of the garrison, who became prisoners of war. The loss thus sustained was the most important that had ever yet visited the American cause. The useless nature of the post itself had been repeatedly demonstrated by the safe passage of British vessels; but twenty-five hundred good soldiers, with a magazine of military stores, were not to be replaced in those days of adversity and discouragement. The evacuation of Fort Lee was immediately determined upon and effected, though with the abandonment of cannon, tents, and provisions.

The American commander passed the North river with a part of his army, and followed the movement of the British into the state of New Jersey. Not being in sufficient force to prevent their successes, he was gradually driven from one position to another, until he at length crossed the Delaware, and took up a position on its right bank, for the purpose of covering Philadelphia. Amid all these disasters, the indefatigable courage of Washington never flagged, and his exertions suffered no intermission because weaker minds considered all as lost. With him, the republic was never to be despaired of, and his army always saw him as calm and collected as when fortune smiled most graciously upon his banners. General Lee was ordered to join him with the rest of the main army which had been left on the east side of the Hudson. General Schuyler, in the north, was directed to march southward with all possible expedition; similar instructions were forwarded to Generals Gates and Heath, and urgent entreaties were addressed to the various states from which succours might be expected in this perilous crisis.

But all of these various armies were suffering under a visitation long anticipated by the watchful eye of Washington, and which had been the constant subject of his thoughts and labours. The time had now again arrived when the soldiers were entitled to their discharges, and no immediate means were provided to supply their places.

The special attention of Congress to this most important consideration, had been invoked in all the letters of their general, and they were at length induced to vote a permanent army, and to increase the pay of officers and soldiers: but these resolutions came too late for the present campaign, and the weak American force was daily thinned by the dissolution of its component parts. Whole regiments retired in a body from the service; so that when the commander-in-chief crossed the Delaware in view of his pursuers, less than three thousand men bore the burthen of freedom and her fortunes.

The American general had been sensible for some time that the only chance of arresting the enemy's progress and recruiting his forces, was by a prudent use of the natural impediments presented by the river Delaware. All the boats for a distance of seventy miles, were therefore collected together and placed under strong guards: and the army was so posted as to cover the several fords accessible to the British. When these arrangements were completed, and the immediate pressure of a formidable pursuit removed, it was possible to wait more patiently for the accession of re-inforcements. Fifteen hundred of the citizens of Philadelphia, embodied for the general defence, joined the army in the neighbourhood of Trenton: General Sullivan arrived with Lee's division, after the surprise and capture of that incautious soldier by the enemy's cavalry: and with other additions, the American forces found themselves augmented to seven thousand men. The British commander made repeated efforts to possess himself of the boats and force his passage across the river; but after several disappointments, he at length desisted and began his preparations for retiring into winter quarters. The main body of the army was cantoned between the Delaware and the Hackensack: about four thousand men occupied positions between Trenton and Mount Holly, and strong detachments lay at Princeton, Brunswick, and Elizabethtown. The object of this dispersion over so wide an extent of country, was to intimidate the people and thus prevent the possibility of recruiting for the continental service; while in the spring these forces could be immediately concentrated, and it was then proposed to put an easy conclusion to all rebellious contumacy.

Washington was now aware that the desperate condition of his country's fortunes could only be retrieved by some equally desperate but successful enterprise. With the exception of about fifteen hundred effectives, his whole force would be entitled, in a few days, to its discharge: and there was no prospect of new accessions, while public opinion looked upon the American arms as without glory or even hope. The daring resolution was therefore adopted, of a combined and general assault upon all the British posts on the Delaware; in the hope that success upon some one point would obliterate the remembrance of former disasters, and impress a lesson of wholesome caution upon the triumphant and contemptuous enemy.

Early in the morning of the 26th of December 1776, the main body of the American army, twenty-four hundred strong, and headed by Washington in person, crossed the river at M'Konkey's ferry, about nine miles above Trenton. The night was tempestuous with rain and sleet, and the river encumbered with quantities of floating ice, so that the passage, although begun soon after midnight, was not fully effected until three o'clock, and one hour more elapsed before the march could be commenced. The Americans moved in two divisions, along the roads leading to the town, and their operations were so well combined, and executed with such precision, that the two attacks on the British outposts were made within three minutes of each other. The pickets attempted resistance, but were almost immediately driven in upon the main body, which was forming hurriedly in line. Colonel Rahl, their commander, soon after fell mortally wounded; the confusion of the soldiery became irremediable, and after a loss of about twenty killed, one thousand men laid down their arms and surrendered their munitions and artillery. On the American side, the loss in battle amounted to only two killed and four wounded, including James Monroe, afterwards president of the United States.

The other parts of this brilliant enterprise were not, however, executed with the same success. General Irvine had been instructed to cross at Trenton ferry, and by securing a bridge below the town, to cut off the enemy's march along the Bordentown road. Notwithstanding all his exertions, it was found that the ice had rendered the passage impracticable, and five hundred fugitives from the disastrous field of Trenton, were thus enabled to escape by a speedy and well-timed retreat. General Cadwallader was to have crossed at Dunk's ferry and carried the post at Mount Holly; but the same impediment prevented this movement also, and he was compelled to return with a part of his infantry which had effected the passage. Deprived of this important and expected co-operation, Washington had nevertheless achieved a most critical and important triumph; he returned to his former position, charged with the spoils and trophies of his foes, and from that moment—though reverses frequently dimmed the brilliancy of the prospect—hope never again deserted the cause of American independence.

Sir William Howe had been fully apprised of the unfortunate condition of his adversary's affairs, and he may well be excused for having treated the war as already at an end. New York was a British garrison: New Jersey completely subdued and occupied by his forces; while Pennsylvania, disheartened and menaced with invasion, seemed about to relinquish all resistance, and prepared to terminate the contest by surrender and submission. All the troops who were entitled to discharges, had quitted the ill-omened ranks of the continental army, and at the commencement of the new year, the dispersion would be almost complete. Nothing then appeared to be necessary, but to wait until the ice should render the river passable, when such a blow could be directed against the American commander, as would close finally the struggles of the young republic. In the midst of these cheering prospects, he found himself suddenly assailed in his positions—a part of his army cut off—and the war revived with new vigour by a skilful and indefatigable adversary. Notwithstanding the advanced state of the season, active operations were at once resolved upon; and for this purpose the British troops were collected together in great strength and high state of preparation.

1777. The American general, encouraged by his late brilliant success, now determined to contend for a footing in the state of Jersey. The army repassed the Delaware and took post at Trenton, where it soon found itself in front of a superior force, owing to a movement in advance of Lord Cornwallis. A little creek called the Assumpink was all that divided the two armies, but night separated the combatants and afforded the opportunity for new combinations. It was evident to Washington that the conflict to which he was exposed, presented no hope of a favourable result, and that a retreat across the river before his present enemy appeared likely to prove a still more disastrous alternative. Amid these critical difficulties, the daring resolution was taken to decamp from his present position, gain the rear of the enemy at Princeton, overthrow the division posted in that town, and then move upon Brunswick, where a weak force guarded the principal depots of the British army. If these extensive operations were followed by an immediate pursuit on the part of Cornwallis, no apprehension was to be entertained for Philadelphia; but if, on the contrary, he pushed forward to that city, the injury, though severe, would be indemnified by the loss of the magazines, the cutting up in detail of the British detachments, and the complete reconquest of the state of Jersey.

At one in the morning of the 3d of January, the camp fires were renewed and the guard paraded as usual; but the army had silently begun its movement upon Princeton, which was known to be occupied by three British regiments. At a short distance from the town they encountered two of these regiments marching forward in order to cooperate in the expected battle; and a warm engagement immediately commenced. The American general was well aware that the existence of his country hung suspended in the scale of victory, and he exerted himself as one who knew the importance of the object, and felt that success depended on his efforts. Wherever the fire was hottest, or the press of battle most fearful, Washington was sure to be found guiding the thunders of war, and animating all by his language and example. At length the British line was broken, and the two regiments separated. Colonel Mawhood, with the division in the van, pushed rapidly forward for the main army, while the fifty-fifth cut off from this point of support, fled in confusion across the fields to Brunswick. The Americans now pressed the remaining regiment, which at first attempted a defence in the college; but this was soon abandoned, and those who were not captured escaped only by precipitate flight. The British loss amounted to one hundred killed, and three hundred prisoners; the conquerors had to lament the death of General Mercer, an experienced officer, much respected by the commander-in-chief.

These remarkable movements upon Trenton and Princeton, contain in themselves all the principles of strategy which are usually considered the original inventions of the French revolution. As examples of a genius beyond the progress of the age, they are brilliant evidences of the military skill of the commander, and have received the meed of unanimous admiration. Sir William Howe had every reason to suppose that his arrangements were those of a prudent and skilful general; his retirement into winter quarters during the inclemency of the season, was justified by the regular customs of the time, founded on the accepted conclusions of military science. But he was opposed to an adversary capable of detecting the errors of ancient dogmas, and strong enough to break their trammels, when their fallacy stood unveiled before his judgment. We have seen Washington keeping the field and preserving the vigour of his operations, in spite of the rules which commanded inactivity; and the British army found its divisions attacked and defeated in detail, while they considered themselves in perfect safety under the shield of all former experience. That principle of warfare which was the secret of Napoleon's victories—the production of a local superiority of force, by concentration against a distant position—was evidently a part of Washington's reasoning, and a main reliance for the success of his enterprises.

The two battles, though similar in their outlines, were very different in point of conception and execution. The attack upon Trenton was a blow struck against an enemy in position, which admitted, therefore, of every advantage of preparation on the part of the assailant. The battle of Princeton belonged to a higher and more elaborate order of tactics. The American forces were already engaged with a superior army, commanded by an officer of eminent reputation; and the change of plan was wholly contrived and executed with the enemy in front. It was entirely due to the prompt genius and fertile resources of Washington, that his army was extricated from so perilous an exposure, and enabled to attack the enemy's rear with such advantage as to leave it no choice but surrender or flight. A military critic, contemplating these inspirations with a soldier's eye, can easily appreciate the feelings of the Great Frederick, when he sent a sword to the American commander, as a gift from the world's oldest general to its *best*.

As a natural result of these unexpected manœuvres, the British officers were thrown into a state of uncertainty, which gave to their subsequent operations an unusual character of timidity. The distant roll of the American artillery at Princeton, first announced to Lord Cornwallis the danger of his rear and the escape of his active adversary. Alarmed for the safety of his magazines, the British commander instantly broke up from the Assumpink, and commenced a forced march upon New Brunswick; moving with such celerity, as nearly to overtake the American rear at Princeton. On the other hand Sir William Howe drew in all his forces, by concentration in the neighbourhood of Amboy and Brunswick, and abandoned all hope of preventing the recruiting service, by overawing the whole extent of the country. Washington, finding the surprise of the stores impossible, moved northward into the Highlands of Jersey, in order to afford some relief to the fatigues of his troops; for long and severe exposure to the inclemencies of the winter, without the usual protections, had produced sickness and even complaint. It was finally considered necessary to abandon offensive operations, and to put the army under cover at Morristown. Among other prudent precautions adopted during this temporary respite, the commander in chief caused the whole army to be inoculated; an operation then very uncommon in America, but which enabled him thereafter to defy a disease which had proved more fatal than the sword of the enemy.

The situation of American affairs—though far from brilliant—was much improved by the late successes. The people of Jersey rose with fresh spirit, and in a number of small skirmishes inflicted loss upon the enemy both in men and stores: new hope was made to animate the public mind; while Congress fanned the flame by judicious and well-timed incitements to vigorous action. Washington was authorised to raise sixteen regiments, and in further testimony of the public confidence, he was invested for six months with almost dictatorial powers in the conduct of the war. It was, however, found to be impossible to collect a sufficient force for active operations upon any considerable scale during the winter. All the hopes of the commander in chief were therefore turned to the next campaign; and in the mean time, an active warfare was carried on with small posts and foraging parties, which greatly annoyed the British army; while the frequent reports of fresh successes excited the spirit of the American people. The most earnest applications were made to the several states, for reinforcements enlisted upon longer terms; for, as Washington strongly observed, "to the short engagements of our troops may be fairly and justly ascribed almost every misfortune that we have experienced." These representations produced at last their due impression; and the hope was abandoned of defending the country by hasty assemblages of militia, and of carrying on a protracted warfare upon the impulse and mere foundation of disinterested patriotism. The safety of our firesides, and the honour of the American arms must always require other and more efficient preparations.

When the season for active operations returned, Sir William Howe directed his first attention to the surprise and destruction of the American magazines. The town of Peekskill on the North river was used as a deposit for the munitions to be distributed among the troops in the Highlands: and at Danbury in Connecticut, there was a considerable collection of useful military stores. These places were attacked by means of expeditions forwarded in shipping, and much damage was done not easily repaired. On the other side, the British stores at Sagg harbour on Long Island, were destroyed by a bold movement executed by Colonel Meigs: who captured also an armed schooner and a number of vessels laden with forage.

The whole continental army under the command of Washington, though much increased, numbered at the commencement of the campaign less than nine thousand men, of whom nearly one third were confined to the hospitals. Exposed under these circumstances to a greatly superior foe, the Fabian policy of caution, delay and strong intrenchments, strongly recommended itself to the general in chief, as the only system of warfare that offered a prospect of ultimate success. From the camp at Morristown, the army was therefore removed to a fortified position at Middlebrook, where it commanded a full view of the enemy's operations, and of the most important points to which they were likely to be directed. A body of militia, with a few regulars, under General Arnold, were also assembled on the western bank of the Delaware, to oppose the passage of that river, in case it should be attempted by the British.

The main object of Sir William Howe, was the capture of Philadelphia; but with a broad and guarded river in front, it was evident that no advance could be made until a blow had been struck against the main continental army. It was equally plain that the lines at Middlebrook were too strong to be the object of direct attack. Sad experience had taught the British general how formidable is the slightest intrenchment protected by the fatal fire of American musketry: his only chance was in the resources of strategy, by which he hoped to seduce the American commander from his position on the heights; to engage on equal terms in the broad plains of Jersey, and to obtain a signal victory by the power of numerical superiority. Accordingly the British forces were made to assume the appearance of an immediate advance upon Philadelphia: marches and countermarches were executed: and every contrivance resorted to, that was considered likely to excite the anxiety of Washington, and to occasion an incautious change in his prudent preparations. The object and plans of the enemy were, however, from the very beginning, wisely foreseen and understood. The movements were followed; but nothing could entice the American army from the strong fastnesses which always covered their marches and encampments. Sir William Howe saw each day the same lowering cloud hanging above and around him; but he found also—like the ancient Carthaginian—that he had no power to disperse its threatening masses, or to command even its thunders to break upon him in the plain.

The British commander was at length wearied out by this unprofitable contest with an enemy who was neither to be deceived nor overpowered. Protected by their position, he fully appreciated the physical force of the American army: and having now fully tested the skill of his adversary, he was satisfied that there was nothing to be gained in the conflict of military science. A new plan was therefore resolved upon, which in its first step involved nothing less than the total abandonment of the state of New Jersey. The British forces fell back to

Amboy, closely followed and constantly harassed by the light divisions and skirmishers of the continental army. Sir William Howe made one last effort to reach the rear of his pursuers, and by cutting them off from the high grounds to compel a battle; but when this was again defeated by the prudence of Washington, he gave up all hope of victory, and passed over to Staten Island for the purpose of embarkation.

The American general had now completely achieved a great and wonderful triumph. With a force exhibiting rather the shadow than the reality of an army, opposed to an enemy superior in number, and still more in every thing that constitutes efficiency in war, he had nevertheless successfully protected the chief city of America, won battles, captured trophies, and finally expelled the British from their proud and important conquest of a whole state. Never in the history of warfare was a greater result obtained by means so inadequate; and of the success itself, never was more due to the talent, the energy and the wisdom of the commander-in-chief.

The plans of Howe now became matters of deep interest, and engrossed a great share of Washington's vigilance and anxiety. With the full command of the ocean, and a powerful fleet, the British general possessed the means of landing his large army on any part of the long line of the American coast, and of attacking important positions while comparatively unprepared and defenceless. There were many points, any one of which was well worthy of the labour of a special expedition; but only two of these fixed Washington's attention, as likely to attract the immediate notice of his adversary. The mountainous passes commanding the navigation of the North river, had long been in the possession of the continentals, and were the sources of constant annoyance to the British communications. As General Burgoyne was known to have assembled a great force upon the lakes, for the purpose of descending upon the state of New York, it appeared probable that Sir William Howe would endeavour to effect a junction of the two armies, after forcing the American posts, and clearing the obstructions which they had so long presented. On the other hand, the capture of Philadelphia was an object of at least equal interest, and there were many circumstances connected with the British preparations, which seemed to announce something more considerable than a mere river voyage. A part of the continental army under General Sullivan was pushed forward to Pompton Plains, for the purpose of approaching the Highlands; but the main body was still so posted as to cover the strong camp at Middlebrook. In the letters of the American general to congress, he exhibited the dangers to which the city was exposed, and strongly recommended the strengthening of the fortifications on the Delaware, and the increasing of the obstructions that had been cast into the channel of the river.

The British army at length embarked, and as the winds bore them from the coast, the mind of the continental commander was relieved from the burthen of at least one apprehension. The American forces were now moved towards the Delaware, with the exception of strong detachments of disciplined troops, which marched northward as reinforcements to the army under Gates. The character of Washington was too noble and elevated to feel any of the emotions of professional jealousy. He knew the immense public advantage that would be derived from the defeat of Burgoyne; and he saw with the practised eye of a soldier, that the movement of Sir William Howe, by opening all the communications, had exposed his colleague to a combined attack from the concentrated forces of the union. Pressing letters were written to the various governors of New England, explaining the crisis, and the importance of immediate exertions. The marches were hastened of all the officers and troops who could be spared upon the expedition; in short, every precaution was adopted which the most zealous foresight could suggest, for the advancement of its own personal and immediate glory.

Time, the great unraveller of all mysteries, at length fully developed the projects of the British commander. In the last days of July 1777, the fleet appeared off the capes of Delaware, but the difficulties of the river navigation induced Sir William Howe to alter a part of his plan, and to transport his army by the more circuitous route of the Chesapeake. Unfavourable winds further delayed the voyage until the 25th of August; on that day, eighteen thousand men, in the most perfect state of military preparation and efficiency, landed at the head of Elk river, for the purpose of terminating the war by a decisive blow against the chief city of the continental Congress.

Washington, on his part, had made all the arrangements suggested by experience and accessible to his limited means. The various divisions of the army were concentrated about Philadelphia, and marched to the Brandywine. General Smallwood was ordered to assemble the Maryland militia at the head of the bay, and to co-operate with the Delaware troops against the British rear; the hardy militia of Pennsylvania joined the main body in considerable force, but owing to the extreme deficiency of the commissariat, great numbers were left, from necessity, unprovided with arms. When the whole army was collected together, the effectives, including irregulars, were about eleven thousand men; and with this force Washington occupied a position behind the Red-Clay creek, on the main road between the city and Sir William Howe's centre of operations.

The main body of the British army, on arriving near the American camp, made demonstrations of an immediate intention to attack; but the wary general-in-chief was soon satisfied that this movement was a mere feint, intended to cover the real object of cutting off his communications with Philadelphia. He therefore crossed the Brandywine with all his forces, and took post at Chadd's Ford, on that stream, extending his line above and below, so as to cover other fords accessible to the enemy. He had now reached the ground upon which he was determined to risk that general battle so long sought for by his adversary, and which was now required for the preservation of the city, by public opinion and the expressed wishes of Congress.

On the 10th of September, Sir William Howe collected his forces at Kennett's Square, about seven miles from his adversary, and with no obstacle between them except the little stream of the Brandywine. The next day, a strong column under General Knyphausen, advanced to Chadd's Ford, skirmished with the American parties, and assumed the appearance of a disposition to force the passage of the river. Intelligence was however sent to Washington, that a detachment of five thousand men, with a number of cannons, had moved up the country to cross at the forks of the Brandywine; and he therefore resolved to take advantage of the temporary separation, by an immediate attack upon the column in front. Before this plan was carried into effect, other reports rendered extremely doubtful both the real nature of the British movement, and the number of troops engaged in it. With a foe so much his superior in force, a bold manœuvre, like the one contemplated, was not to be adventured on without the most positive information; for once fully exposed on the other side of the Brandywine, there would have been no retreat left for the Americans, nor any possibility of success. The first intelligence was at length confirmed; but Lord Cornwallis had already effected his passage at the forks, and after a circuitous march of seventeen miles, was advancing in force to the attack. Wayne's division remained at Chadd's Ford, opposed to Knyphausen; the three divisions of Sullivan, Sterling and Stephens marched up the river to check the British detachment, while Washington took post in the centre, about equidistant from the two wings.

About four o'clock in the afternoon, Lord Cornwallis encountered the American right; this division was defeated after a brisk engagement, but Washington checked the pursuit by a movement from the centre. Knyphausen now made a real attack for the purpose of gaining Chadd's Ford, upon which Wayne effected an orderly retreat, having learned the ill success of the first conflict. Thus terminated the battle of Brandywine. The continental army arrived next day unmolested at Philadelphia, having lost three hundred killed, six hundred wounded (including General La Fayette) and between three and four hundred prisoners. The British loss was officially stated at one hundred killed and four hundred wounded. The immediate causes of the check sustained by the Americans on this occasion, are found in the inexperience of the troops engaged, and the great deficiency in their fire-arms, which were of unequal calibres, and therefore badly fitted by the cartridges; but in every event, the formidable superiority in numbers on the side of the British, could have left no hope of a positive victory. The results of the battle were treated by Congress and the army as far from decisive. The former passed vigorous resolutions, and evinced no intention of quitting their place of session. The latter recrossed the Schuylkill, after a short repose, and marched along the Lancaster road, for the purpose of inviting another contest with their elated adversaries.

The advanced parties of the two armies met on the 16th of September, in the neighbourhood of the Warren Tavern, about twenty-three miles from the city; upon which a sharp skirmish was carried on, until the combatants were separated by a heavy storm. The American troops were never exposed to greater peril than that to which they were brought on this occasion, by the power of the elements and their deficiency in the common tools of warfare. Their cartridge-boxes were so badly made as to afford no sufficient cover to the ammunition, and the gun-locks being ill secured, became wholly unfit for service. As no alternative was now left to soldiers unprovided with bayonets, Washington was compelled to order a retreat to the Yellow Springs, and to abandon reluctantly his plan of battle. A farther retreat to Warwick Furnace, on the south branch of French creek, was afterwards found necessary; for, by a general inspection of arms, the unfortunate truth was ascertained, that scarcely one musket in a whole regiment was capable of being discharged, and the cartridges were in a condition equally alarming. The British army halted during two days, in consequence of the extreme severity of the weather. It was about this time that General Wayne, detached by Washington for the purpose of harassing the enemy's rear, was surprised by General Gray, and obliged to fall back with considerable loss. A court-martial, assembled at Wayne's request to inquire into the circumstances of his disaster, unanimously acquitted him of all blame, declaring "that he had done every thing to be expected from an active, brave and vigilant officer."

Sir William Howe advanced to the Schuylkill and fixed his camp in front of the Americans, extending from French Creek to the Fatland Ford. From this point he reconnoitred the strong position assumed by Washington, which deterred him from his original plan of attack, and changed his movement into a march upon Philadelphia. Popular clamour, which has so often conquered the better judgment of generals, now loudly required that a great battle should be fought for the defence of the American metropolis: the commander-in-chief—with that generous intrepidity which formed one of his noblest characteristics—resolved to withstand the torrent by declining a conflict that could only terminate in the destruction of the cause of his country. Congress removed from the city and immediately re-assembled at Lancaster. On the twenty-sixth of September, Philadelphia fell into the hands of Sir William Howe: but the precautions of the American general saved the public property, by a timely removal of the military stores up the river Delaware.

The expected reinforcements of regulars and militia having generally reached the American camp, Washington with his army of eleven thousand men, gradually approached the city, for the double purpose of observing the enemy and selecting the proper moment for attack. He found a strong body of the British forces encamped at Germantown, a village of a single street, beginning about five miles from Philadelphia, and extending along the road about two miles more. Lord Cornwallis occupied the city with another division, and a numerous detachment had marched to Chester, as an escort for a convoy of provisions. A fair opportunity for assailing the enemy in detail was thus offered to the enterprise of the American commander, and he was not slow in perceiving its advantages. He accordingly chose for his point of assault the advanced camp at Germantown, and made masterly arrangements for surrounding and destroying that exposed division of the enemy, before reinforcements could arrive from Philadelphia. Sullivan and Wayne were charged with the attack of the village in front, by the main street from the side of Chesnut hill. General Armstrong with the Pennsylvania militia was to move upon the rear, along the line of the Ridge-road, turning the enemy's left flank; the same movement was to be effected on their right by Generals Smallwood and Forman, down the Old York road. Another column under Greene and Stephens was to attack the right wing in the centre of the town, and the command of the reserve was entrusted to Lord Stirling.

Before sun-rise on the fourth of October, Sullivan and Wayne attacked and drove in the British outposts, and forced the light infantry and the fortieth regiment to give way with the loss of all their baggage. Their commanding officer, Colonel Musgrave, hotly pressed by the conquerors, threw himself with five companies into Chew's house, a large stone structure near the road, which enabled him to pour a destructive fire of musketry upon the advancing Americans, without the possibility of a dangerous return. Some resolute attempts to storm the building were repulsed with loss, and as field pieces could make no impression, a corps of observation was left behind, while the column marched on, divided into two bodies. The attack of the right wing by the four brigades under Greene and Stephens, completely broke the British advance of light infantry, and Greene pushing forward with half of the division, routed a part of the main body, entered Germantown, and made a number of prisoners. Woodford's brigade under Stephens, unfortunately allowed itself to be separated from the rest of the division, before Chew's house, and much time was wasted in a second ineffectual cannonade from light field pieces upon that massive building. Still the British troops were retreating on every side: the prospect of success was extremely flattering, and with disciplined troops, capable of executing complicated movements with regularity and order, a decisive victory must have been the unquestionable result. Our narration has now to explain the causes which deranged the whole order of the enterprise, and rendered the first successes ultimately abortive.

It has already been stated that two of the American columns were respectively subdivided at Chew's house, in consequence of the unlooked for resistance of its British garrison. The troops were further scattered in a pursuit conducted with unequal vigour, over a country full of hedges and inclosures. Washington, perceiving the increasing confusion, exerted himself strenuously to check the evil; but the darkness of the morning, which had been calculated on as an advantage, now prevented the rallying of the several divisions, and proved the most serious obstacle to success. The general could only obtain an imperfect view of the field of operations, and the parties which approached each other, were unable to distinguish their comrades from the enemy. The two advances upon the enemy's rear, by the right and left flanks, were made too late to be of any utility, and thus the weight of the American attack which depended wholly on concentration, was frittered away and lost.

The British army now recovered from its first surprise—rallied the fugitives—and prepared vigorously to assume the offensive. A fierce attack was made on Greene, who after a warm action, was compelled to retire from the town. Sullivan, hotly assailed by the brigades of Knyphausen, also retreated, and great disorder prevailed every where. Washington was now convinced of the absolute necessity of withdrawing his troops from the contest. The disputed town was therefore evacuated by the Americans and the army marched towards the Perkiomen, without loss or even pursuit from their exhausted opponents. On receiving a slight reinforcement, the continental forces again returned to the neighbourhood of the city and encamped at Skippack creek.

According to the official returns of the English general, his loss in the battle of Germantown scarcely exceeded five hundred men. On the side of the Americans, two hundred were killed, more than five hundred wounded, and four hundred made prisoners. Congress passed a resolution highly commending the plan of the battle, and thanking their commander and the army for their courage and conduct. Perhaps, without hyper-criticism, it may be observed as a fault, that the general design reposed too much reliance on the precision of troops, at best but imperfectly disciplined. Converging movements depend for success on the nicest execution of the plan by the several divisions, and are liable to all kinds of untoward disappointments, even when executed with the best instruments. It is for this reason that they seem to be at present rejected by the best authorities in military science, which give the preference to operations radiating from a fixed centre.

The main object of the American commander was now to compel the evacuation of Philadelphia, by cutting off the supplies of the British army. The fleet was effectually prevented from co-operation by the obstructions fixed in the channel of the Delaware, and by two small forts—one, called Fort Mifflin, on Mud island, near the confluence of the Delaware and Schuylkill, and the other at Red Bank, on the opposite Jersey shore. Strong parties of militia scoured the whole country in the neighbourhood of the city, for the purpose of enforcing the resolution of Congress, which subjected to martial law all persons supplying provisions to the enemy.

Sir William Howe soon felt the increasing difficulties of his situation, and began to prepare his plans for their forcible removal. Works were erected against fort Mifflin, which produced severe conflicts with Colonel Samuel Smith, who commanded the station. Lord Howe came up the river with his ships of war and transports, and anchored from Newcastle to Reedy Island; some frigates being detached in advance to remove the chevaux de frise that encumbered the channel. Considerable difficulties were encountered in effecting this object, so that the obstructions below Mud Island were not cleared until the middle of October, while those covered by the American guns were yet untouched. The capture of the forts was therefore the next object, and it was accordingly attempted by a combined attack on land and water.

On the twenty-second of October 1777, Count Donop, a German officer, with twelve hundred men, assailed the works at Red Bank, which were defended with the usual vigour of American troops—even the freshest militia—when covered by a slight intrenchment. At the same time, five British vessels sailed up the river, and in concert with their land batteries, opened a heavy fire on Fort Mifflin. The Hessians fought with great gallantry, but were repulsed by Colonel Greene, with the loss of Count Donop and one third of their number. The cannonade from the shipping continued without intermission until night interrupted the conflict and concealed from the Americans the dangerous situation of the line of battle ship Augusta and sloop of war Merlin, which had grounded within the range of the guns of the fort. The next morning the action re-commenced; but at length the British withdrew, after setting fire to the Merlin, and abandoning the Augusta, which shortly afterwards blew up.

Notwithstanding this brilliant success, the position of Fort Mifflin was extremely critical. It was known to be a rude fortification, strongly intrenched in front, but defended in the rear by only a ditch and palisade. Sir William Howe was, therefore, by no means discouraged by these disasters, from the prosecution of his purpose, which, as it involved the secure possession of Philadelphia, was too important to be abandoned except at the last extremity. He now proceeded with great circumspection, withdrawing all his outposts, uniting his whole force in the city, and prosecuting his measures so as to insure a slow but ultimate success. Matters were in this situation, when news came of the British disasters in the north, and of the sudden termination of the war in that quarter. The important change thus effected in the posture of American affairs, altered also the relations of the two armies. It was now of extreme consequence to Sir William Howe, to anticipate the arrival of the re-inforcements to his adversary, which might be expected from the victorious army of the North: while, on the other hand, it was the policy of Washington to preserve if possible, his present strong-holds, and to avoid an action until joined by the new troops.

On the tenth of November, the attack was renewed on Fort Mifflin, from a heavy battery on Province Island, within the distance of five hundred yards. The cannonade was continued almost incessantly for several days, and produced considerable impression. The American guns were nearly all dismounted, the block-houses and palisades beaten down, and the small garrison wearied out by the necessity for unremitting exertion. Washington sent relief to the officers of the fort; but his instructions were positive that the place should be maintained to the last extremity, and they were strictly and literally obeyed. The besiegers, finding that all their means would be required to attain success, called in the assistance of their fleet. It was ascertained that in consequence of the obstructions thrown into other parts of the river, the current had deepened the inner channel between Mud and Province Islands, so as to admit of safe navigation for vessels of considerable burthen. The frigate Vigilant and a sloop of war were brought up this channel and anchored within a hundred yards of the rear of the fort, from which position they were enabled to pour a destructive fire of cannon, musketry and grenades. It was now evident that the post was no longer tenable; and on the sixteenth, after some unsuccessful attempts to dislodge the vessels, the garrison was withdrawn under cover of the night, leaving Sir William Howe in possession of the whole line from the Schuylkill to the Delaware.

The next effort of the British general was directed against the post at Red Bank, called Fort Mercer. The arrival of a strong reinforcement from New York, enabled him to detach a sufficient force upon that enterprise, without any hazard to his own position from a coup-de-main. The fort was evacuated on the approach of Lord Cornwallis, whose strength was such as to render resistance hopeless. General Greene had been ordered by Washington to follow this movement, for the double purpose of assisting in the defence of fort Mercer, and of giving battle to the British commander at the first favourable opportunity; but as none such presented itself, this judicious officer came to no engagement, and returned with his forces to the commander-in-chief. The results of these operations fully secured Sir William Howe in his conquest of Philadelphia, and in the possession of an uninterrupted communication between his army and the fleet.

While these operations were fully employing the armies of Washington and Sir William Howe, events had transpired in the north of great and varied importance. After a series of battles and sieges, the plan which had been formed by the British to penetrate from Canada to the Hudson was completely frustrated; and General Burgoyne found himself obliged, at Saratoga, to surrender his whole army as prisoners of war to the American forces under General Gates. Sir Henry Clinton attempted a diversion on the Hudson for the purpose of extricating his colleague; but the movement was undertaken too late, and produced no result beyond the capture of several posts which guarded the passes and prevented the navigation of the river.

Public opinion, elated by the brilliant success of Gates, and rising into confidence with the apparent discouragement of the British ministry and nation, now loudly required that some effort should be made to surprise and storm the city. Invidious comparisons were openly drawn between the two commanders, by a strong party hostile to the general-in-chief. The triumph of the one and the comparative inactivity of the other, were traced to a difference in their respective characters and abilities. It was urged also that the rapid depreciation of paper money would extinguish the national resources, unless confidence were revived by the striking of a decisive blow. The greatness of Washington's mind and his peculiar fitness for the times in which he was placed, were again wonderfully exhibited. Had he possessed in his temperament, the least mixture of personal vanity or envy, or had the firm resolution of his mind been capable of impression from the force of public clamour or private importunity, the independence of his country would, in all human probability, have been arrested or annihilated at this crisis.

The two armies were about equal in point of numbers; but the British were strongly intrenched behind a line of redoubts, extending from the Delaware, which covered the right of their position, to the Schuylkill on the left, while their rear was protected by the junction of the rivers and the city of Philadelphia. A failure of the attack upon these intrenchments was fraught with consequences too dangerous to be hazarded, except in the last extremity: it was besides evident that Sir William Howe must either invite battle upon more equal terms, or confess timidity, in the face of the whole country. The diminished value of the continental paper was due to a bad system of finance, which had provided no adequate taxation to secure the immense emission, and was not to be remedied by the hazardous exposure of the main strength of the American cause. The prudent judgment of Washington prevailed over all personal considerations: he resisted the difficulties with which he was encompassed, and the award of history will shed an eternal lustre over his wisdom, while the clamours of the day have already sunk into obscurity.

The correctness of Washington's foresight was soon proved. On the fourth of December 1777, Sir William Howe marched from Philadelphia with fourteen thousand men, with the declared intention of giving battle to the Americans. His first encampment was upon Chesnut Hill; the Americans occupied another range of hills opposite, but converging to the north towards that possessed by the British. On the seventh, Howe changed his position by moving along the hills and approaching within a mile of Washington's left. During these operations, sharp skirmishes took place, in which the British loss was about one hundred men, and that of the continentals scarcely less, including Major Morris killed, and General Irvine severely wounded; but the attention of all was fixed upon the expected general engagement, for which the commander-in-chief had made the most active preparations. On the eighth, instead of the anticipated attack, Sir William Howe suddenly broke up his camp, and fell back with great rapidity upon Philadelphia.

The great severity of the season now rendered it necessary that the army should be disposed in winter quarters. Accordingly, on the eleventh of December, the main body of the Americans commenced their march to Valley Forge, a good position about twenty-five miles from Philadelphia, on the western side of the Schuylkill, and equally distant from the Delaware above and below the city. Here, after a slight skirmish with a detachment under Lord Cornwallis, a permanent camp was formed of log huts, with the interstices closed with mortar. In order to prevent all intercourse between the British army and the country, General Smallwood with his division took post at Wilmington. General Armstrong and the Pennsylvania militia were stationed at Whitemarsh; Colonel Morgan was in the lines on the west side of the Schuylkill, and the whole country was scoured by troops of cavalry.

On the twenty-second of December, when Washington was about to advance his troops upon Derby, for the purpose of disturbing the British in the removal of forage, it was ascertained that the last rations in the commissary department had been distributed to the forces. The calamities frequently arising from like deficiencies, had been the repeated subject of strong representations to Congress; but the system adopted tended rather to increase than to alleviate the difficulties of the army. The commander-in-chief was empowered to seize all provisions within seventy miles of head quarters, giving in return a certificate to be redeemed by the United States. No funds were, however, provided to meet these demands, and as Sir William Howe paid liberally in gold and silver for all that was conveyed into the city, invidious comparisons were naturally drawn, which tended much to diminish the popularity of the American cause. Washington immediately exercised his authority so as to collect such supplies as were absolutely necessary; but his conduct was loudly complained of by the people for its rigour, and by Congress for its lenity. In reply to new orders from the board of war, directing an increase of severity, he observed that such coercive measures were only to be resorted to, when the alternative presented was the dissolution of the forces—that a present relief was thus provided at the certain expense of growing disaffection—and that the result would be ruinous, not only to the people, but to the army itself, in which a spirit of licentiousness and plunder must necessarily be generated.

During this winter, an organized conspiracy plainly exhibited itself against the general in chief; the parties to which were several military officers and members of Congress. The triumph of General Gates at Saratoga, was urged as an evidence of what might be expected from a change in the command of the main army; and the conduct of that officer himself, left no doubt of his giving encouragement to the disaffected. A new board of war was established, of which Gates was made president; General Mifflin, another officer belonging to the party, was nominated a member, and Brigadier-General Conway, who had written contemptuous letters about the commander-in-chief, was elevated a grade above all his seniors, and appointed inspector general. The legislature of Pennsylvania, irritated by the continuance of the enemy in Philadelphia, expressed their dissatisfaction with the management of the army, in a strenuous remonstrance to Congress. The conduct of Washington under these trying circumstances, was such as might have been expected from his patriotism and dignity of character. General Gates was given to know that his machinations were understood: but it was without querulousness or deprecation. Whenever definite charges were produced, investigation was earnestly courted. "There is no officer," said Washington, "in the service of the United States, that would return to the sweets of domestic life with more heartfelt joy than I should. But I would have this declaration accompanied by these sentiments, that while the public are satisfied with my endeavours, I mean not to shrink from the cause: but the moment her voice, not that of faction, calls upon me to resign, I shall do it with as much pleasure as ever the wearied traveller retired to rest." The conspirators found it impossible to shake the confidence of the people and the army in their tried commander, and all efforts only recoiled upon themselves. Even the northern army which had won its laurels under Gates, expressed a preference for Washington. General Conway resigned his commission in order to escape the voice of universal condemnation; shortly afterwards, while suffering under a wound believed to be mortal, received in duel with General Cadwalader, he addressed a letter of repentance to Washington, acknowledging his character as a "great and good man," and hoping that he might, "long enjoy the love, veneration and esteem of these states, whose liberties he had asserted by his virtues."

The war of the American revolution was truly "a history of false hopes and temporary devices," and it presents us with a constant narration of suffering and danger; but it may well be questioned whether any period was more pregnant with both, than the winter of the encampment at Valley Forge. At one time "there was not a single hoof of any kind to slaughter, and not more than twenty-five barrels of flour;" while the commissary was unable to "tell when to expect any." In the beginning of February, the commissaries gave notice that the country was exhausted to a great distance around the camp, and that no supplies could be procured beyond the month. In the way of covering, "few men had more than one shirt, many only the moiety of one, and some none at all." By the field return, it appeared that "besides a number of men confined to hospitals for want of shoes, and others in farm-houses on the same account, no less than two thousand eight hundred and ninety-eight men were then in camp unfit for duty, because they were barefoot and otherwise naked." Putrid fevers added the malignity of pestilence to the other distresses of the soldiers, and while these calamities were rapidly impairing the strength of the army, a spirit scarcely less dangerous was beginning to prevail among the officers. The depreciation of the continental money had now become so great, that the pay of an officer had ceased to be valuable, and was inadequate to the maintenance of a decent appearance; there arose on this account a general carelessness about the holding of commissions, which led officers into a habitual contempt of the obligations of duty, and afterwards produced resignations in order to avoid censure. There can be but little doubt, that a bold effort, made with the well-equipped army of Sir William Howe, would have forced the American lines, and perhaps concluded the whole warfare. The usual prudence of the British general's tactics again prevailed, and the circle of the war was confined to a few skirmishes of partisans and foraging detachments.

The impression produced in England by the convention at Saratoga, changed the tone of the ministry, and induced the passage of such laws as were supposed likely to satisfy the people of America. Governor Tryon immediately enclosed the bills to Washington, with the extraordinary request that they should be communicated to the army. This communication was immediately transmitted to Congress, where resolutions were passed reviewing the fallacies of the British enactments with great skill and severity. General Washington acknowledged the receipt of Tryon's letter, and transmitted in return the answer of Congress; at the same time, he begged him to be instrumental in spreading the resolutions among those who were likely to be influenced by their reasoning.

During these transactions, the whole country was suddenly filled with joy and exultation, by the receipt of official intelligence that a treaty of alliance, commerce and friendship, had been signed between the king of France and the United States. The British government treated this act as a declaration of war, and in a manifesto announced its reasons for an immediate commencement of hostilities.

The position at Valley Forge had been selected by Washington, as offering the best advantages for covering the country, and depriving the enemy of his necessary supplies. The wisdom of the choice was exhibited by the sufferings of the British army, which in spite of abundant wealth, was obliged to detach numerous parties in order to procure forage and provisions. In the course of these expeditions, the soldiery committed much useless devastation, thus distressing and exciting the people without the least prospect of any military results. The last and most important enterprise undertaken by Sir William Howe, was an attempt to surprise General Lafayette at Barren Hill, under cover of the night; but the continental force, by some skilful manœuvres, effected, in the language of the commander-in-chief, "a timely and handsome retreat;" which added to the high esteem already entertained for the merit of the marquis and his devotion to the American cause. Sir William Howe then resigned his command to Sir Henry Clinton; and as the probable approach of a French fleet rendered Philadelphia a dangerous position, it was resolved to evacuate the city, and to withdraw the whole British force from the Delaware.

The arrangements for this important movement soon attracted the attention of the commander-in-chief. Every preparation was made to impede the march of the enemy through the state of New Jersey; the militia were collected, and a force of regulars marched to their assistance. On the 17th of June, Sir Henry Clinton commenced the passage of the Delaware; on the 18th, the whole army of ten thousand effective men were on the Jersey shore, from which they marched slowly, with a heavy incumbrance of baggage. Washington crossed the river at Coryell's Ferry, with a force about equal to that of the British, and by occupying the higher grounds, preserved the power of delivering or avoiding battle. The former course had been declared unadvisable by a council of war, according to the opinion expressed by General Lee; it was contended by this officer, with all the weight due to his reputation and experience, that as nothing in the present prosperous condition of American affairs could prevent the certainty of independence, except the loss in battle of the main army, such a risk could not be voluntarily hazarded without crime. Of seventeen general officers, Wayne and Cadwalader alone were decidedly in favour of attacking the enemy; Lafayette appeared to incline that way; and Greene considered that an engagement should be hazarded, if rendered necessary, by the bounden duty of the army to protect the country. Washington reluctantly assented to the decision of the council; powerful reinforcements, however, were sent to strengthen the corps on the left flank of the enemy, with orders to give him every annoyance, and even to attack, should a proper opportunity present itself. The command of this important division was given to Lafayette, who filed off towards Englishtown, while the main body moved on Cranberry, in order to give support if required. General Lee, at his earnest request, was detached to reinforce and command the van, which now amounted to five thousand men.

On the morning of the 28th of June, Sir Henry broke up from a strong encampment on the high grounds about Monmouth Court House, and continued his retreat. The baggage was in front, under the charge of General Knyphausen, while the strength of the army formed the rear division, under the special command of Lord Cornwallis. As the British were then within twelve miles of the heights of Middletown, which would place them in perfect security, Washington sent orders to Lee to attack their rear the moment it was in motion.

The first plan formed by General Lee for the execution of these orders, was to check the retreat of the British rear by a vigorous attack from Wayne's corps, while he gained their front by a shorter road, and intercepted their communication with the line. Before this scheme could be carried into operation, suspicion arose that some mistake existed as to the actual force of the division about to be assailed. Lee advanced to reconnoitre, and at the same time Sir Henry Clinton counter-marched with his whole force to the rear, in order by a menacing movement to deter the Americans from any attempt upon his baggage. These manœuvres brought the two armies into collision on a ground disadvantageous to the continentals. After great hesitation in his movements, Lee finally ordered a general retreat of his detachment, for the purpose of regaining the heights. Some slight skirmishing took place, without any other effect than to give notice that a conflict had commenced.

The rear of the Americans now moved rapidly forward to support the front. General Washington rode out full of hope and confidence, when to his utter astonishment he perceived the latter division in full retreat, without fighting or even understanding the reasons of this unexpected movement. Some warm expressions to General Lee exhibited the strong displeasure of the American commander, and instant measures were adopted for arresting the advance of the English, and for re-forming the troops involved in the disorder. The left wing and second line were drawn up on an eminence covered in front by a morass; Lord Stirling, who commanded the former, with the aid of Carrington's artillery, repulsed the attack of a British column, and effectually checked their forward movement.

The next effort of the enemy was to turn the left flank of the Americans, but in this they were roughly repulsed. Another attempt on the left was defeated with loss, by the judicious advance of the artillery and infantry under Greene. At this moment of confusion, the coming up of Wayne compelled the British to retire to the same ground occupied before the arrival of Washington, where their flanks were covered by morasses and thick woods, and their front was accessible only by a narrow passage. Undeterred by these difficulties, which were increased by the heat of the day and fatigue of the troops, Washington resolved immediately to renew the battle. The artillery was advanced and opened its fire on the British flank. General Poor, with his own brigade and that of North Carolina, was ordered to turn the right flank of the enemy, while Woodford's brigade was directed on their left. Unfortunately the impediments of the ground were of such a nature as to protract the completion of these dispositions until the approach of night, for which reason the action was discontinued with the intention of recommencing the struggle on the ensuing morning. The flanking brigades remained in their respective position; and Washington passed the night in his cloak, in the midst of his soldiers, who bivouacked on the field of battle.

The British commander was, however, by no means disposed to try again the fate of arms. About midnight, after removing the wounded, he continued his retreat with so much caution and silence as to give no notice or alarm. At day break he was already so near the heights of Middletown, as to render pursuit useless. The American commander moved towards the North river, after detaching a small force to hover around the British rear, while the enemy embarked at Sandy Hook and proceeded to New York.

Thus terminated the battle of Monmouth, which was claimed as a victory by both parties, because neither had gained any decisive advantage. Clinton effected his retreat and saved his baggage; but the Americans, after the check of Lee's van, repulsed the enemy, became in turn the assailants, and were only prevented from continuing the engagement by the midnight retreat of the British. "Never," said Lafayette, "was General Washington greater in war than in this action. His presence stopped the retreat—his dispositions fixed the victory. His fine appearance on horseback—his calm courage, roused by the vexation of the morning, gave him the interest calculated to excite enthusiasm." The American loss was eight officers and sixty-one privates killed, and about one hundred and sixty wounded. The English army is known to have suffered more than double the amount. In the course of their retreat, they lost about one hundred men in prisoners, and nearly one thousand deserters. The fiery insubordination of General Lee afterwards overcame the reluctance of the commander-in-chief, and compelled the ordering of a court of inquiry, which condemned that officer to one year's suspension. This sentence was almost unanimously approved by Congress, while it gave great and general satisfaction to the American army. A resolution of Congress was unanimously passed, thanking Washington for his activity, his distinguished exertions, and his great good conduct in the pursuit of the enemy, and the battle of Monmouth; he was requested also to signify the gratitude of Congress to the officers and men who had deserved it by their valour and behaviour.

Intelligence was now received that the French admiral, Count D'Estaing, had appeared off the coast of Virginia with a fleet of twelve ships of the line and six frigates, having on board a respectable body of land troops. The original plan of these allies had been to attack the British naval force in the Delaware, and to unite with Washington in a general assault upon the lines at Philadelphia. A passage unusually tempestuous and protracted defeated this well conceived operation, and probably saved the whole power of the British commander.

The chief anxiety of Congress was to secure the immediate co-operation of the European re-inforcement. The American General despatched Colonel Laurens to the French fleet, for the purpose of communicating all necessary information, and concerting the plan of movements with the conventional signals. Colonel Hamilton proceeded afterwards on the same mission, and it was determined that an attack should be made on the British force at Newport, in Rhode Island, by the French in concert with an American army under Greene, Sullivan and Lafayette. Lord Howe sailed with his fleet to relieve General Pigot in his dangerous position, and thus every appearance seemed to indicate the approach of a decisive conflict. Some unfortunate differences upon points of military etiquette, arising between D'Estaing and Sullivan, prevented the immediate disembarkation of the French troops: the two fleets, after a series of manœuvres, were dispersed by a tempest, at the very moment of engagement, and the next communication announced the intention of the allies to sail to Boston. The Americans were, in consequence, obliged to break up their positions and raise the siege; an operation which was not performed without some sharp though indecisive combats.

The effects of these operations upon the feelings of the army and the people, created more disquietude in the mind of Washington, than even the failure of an expedition, in which success had been confidently and proudly expected. Animosities had arisen between the military officers of the allied powers, tending to jeopard every enterprise undertaken in concert; while the discontent of the people had risen to such a head as to leave it doubtful whether the damages of the fleet could be repaired in Boston. The French also had their complaints of alleged injuries: "They are a people," as was observed in a letter of the commander-in-chief to Sullivan, "old in war, very strict in military etiquette, and apt to take fire when others seem scarcely warm." Washington devoted his whole mind to the conciliation of these difficulties, and with the aid of Congress, his labours were finally crowned by the complete restoration of that harmony which was so essentially necessary to success.

On the third of November, Count D'Estaing sailed with all the French forces for the West Indies: whither he was followed by five thousand men under General Gray, with a strong convoy. In the month of December the continental troops retired into hut cantonments in Connecticut—on both sides of the North river about West Point—and at Middlebrook. Their condition with respect to clothing was much improved by supplies from France, and they were thus enabled to disregard other inconveniences. Some few skirmishes had occurred between parties of both armies. The British succeeded in surprising Colonel Baylor's cavalry at Taupaun, where the bayonet was used with inhuman severity: Count Pulaski was also unexpectedly attacked in Jersey, and sustained some loss. On the part of the Americans, a body of chasseurs and yagers under Donop was defeated by Colonel Richard Butler. A British force commanded by Colonel Campbell, sailed under the escort of Commodore Hyde Parker, to act against the southern states, where the climate admitted of military operations: but the garrison left in New York was still too strong to encourage any enterprise against that important position. Washington proceeded to Philadelphia, to hold a personal conference with Congress on the general state of the army and the country. An expedition projected against Canada was abandoned in deference to his opinion, and all recommendations emanating from him commanded the most respectful consideration.

The preparations for the campaign of 1779 were commenced under unfavourable auspices, in consequence of the languor which began to spread itself over the whole nation. A general belief prevailed that the alliance with France had secured our independence, and that all painful exertions were therefore rendered unnecessary. This delusion never extended itself to the mind of the commander-in-chief, who saw plainly how remote was the prospect of any peace that exacted so much from the powerful empire of Great Britain. In a private letter to one of his friends, he thus expressed himself, "I have seen without despondency, even for a moment, the hours which America has styled her gloomy ones; but I have beheld no day since the commencement of hostilities, when I have thought her liberties in such imminent danger as at present." "Do not, from a mistaken opinion that we are to sit down under our vine and our own fig tree, let our hitherto noble struggle end in ignominy." The usual difficulties presented themselves, in relation to bounties, enlistments and state quotas; and yet such was the inertness of Congress, that all measures were yet to be adopted for raising men, when the army should have been in full and active operation.

The first enterprise proposed to Congress by the commander-in-chief, was a decisive movement against the Indians, to punish the atrocities committed in the course of the preceding year upon the inhabitants of the west, and to prevent future incursions. The settlement of Wyoming in Pennsylvania, had been completely destroyed by a body of tories and savages commanded by Colonel John Butler and the celebrated Indian chief, Brandt: while in other parts of the frontier, the tomahawk and scalping knife had been employed with such fearful barbarity, as to render this expedition of primary importance. The experience of Washington had abundantly taught him that an Indian war should never be defensive, and that to obtain peace, the dangers of the conflict and the ravages of a hostile force must be carried into the heart of their own settlements. A plan for surprising the towns of the Onondagos was executed with equal ability and success by Colonel Van Schaick. At the same time a large body of troops prepared to march into the other territories of the Six-Nations. This expedition which was commanded by General Sullivan, proved completely successful, and a severe chastisement was inflicted on all the tribes composing that great Indian confederacy.

At the opening of the campaign, the British force under Sir Henry Clinton, was between sixteen and seventeen thousand strong: opposed to them were about thirteen thousand Americans, cantoned on both sides of the North River, and of course reduced to a defensive warfare. Troops of both nations had been detached to the southern states, and General Gates covered New England with about three thousand men.

Towards the end of May 1779, Sir Henry Clinton commenced active operations by a partially successful expedition up the Hudson. The great road offering the easiest communication between the eastern and middle states, crosses that river at a place called King's Ferry, some miles below West Point. The ferry is commanded on the west by Stony Point, an elevated peninsula on which some works were begun: on the east it is exposed to a long flat neck of land called Verplank's Point, where a small fort had been erected, called Fort Fayette, garrisoned by a company under Captain Armstrong. The British army, commanded by Clinton in person, and convoyed by Sir George Collier, proceeded up the river, captured the position after some resistance, and completed the works at both forts; Stony Point in particular was placed in a strong state of defence. The main army was then withdrawn to Philipsburg without further effort: but there can be no doubt, from the disproportionate means employed, that much more had been contemplated by the British commander.

West Point had now become a most important post to the American cause, on account of its command of the navigation of the river: it was menaced by this armament and most probably owed its safety to the prompt operations of Washington, who had closely followed the enemy's movements, and so posted his army as to deter them from a further prosecution of the enterprise.

Clinton now resolved upon the invasion of Connecticut; the refugee Governor Tryon, with a strong corps of twenty six hundred men, was detached upon this service, which was conducted in a manner more resembling the maraud of banditti, than an operation of soldiers. Washington, on his part, approached King's Ferry, with an anxious resolution to recover the captured posts. When his plans were matured, the execution was entrusted to Anthony Wayne, who stormed Stony Point at night with fixed bayonets, and captured the whole British garrison without discharging a single musket. Fort Fayette was next attempted; but owing to those accidents which are inseparable in war from the best devised projects, the breach advanced slowly. Time was thus afforded to Sir Henry Clinton, who, abandoning his designs on Connecticut, marched directly to the Highlands and relieved his garrison. As the occupation of Stony Point required fifteen hundred men, and the possession of Fort Fayette by the English rendered the post of little value, Washington abandoned his brilliant conquest. The two armies then cautiously observed each other; until at length, the British commander, wearied with inaction, retired to York Island, finding that he could neither attack the Americans with a chance of success, nor draw them from their positions into more favourable ground. He now occupied himself chiefly in strengthening his fortifications, in anticipation of the projected departure of large forces to the south.

The remainder of the summer of 1779 passed away in the northern states without further movements. In Europe, after long diplomatic negotiations and many fruitless attempts at mediation, the king of Spain declared his intention of taking part in the war against Great Britain. This event was of extreme importance, because an union of the French and Spanish fleets promised a maritime superiority in all parts of the ocean. At the proper season, the Americans formed their hutted camps in the various posts selected for winter quarters. The northern division, commanded by General Heath, was so cantoned as to protect West Point and all the neighbouring country. The southern or main division lay in the vicinity of Morristown. The commander-in-chief was then obliged to resume his regular winter's employment of explaining to Congress the defects and insufficiencies of the existing military arrangements, and of earnestly pressing for the supplies of men and provisions that must be necessary to the early commencement of hostilities in the spring.

The inactivity of the northern armies gave an undivided interest to the military operations conducted in the southern states. It has already been stated that a detachment under Colonel Campbell sailed from New York about the end of November 1778; owing to the total want of preparation, Savannah and the whole state of Georgia fell an easy conquest to these troops, assisted by General Prevost, who had moved northward from East Florida for that purpose. South Carolina was defended by General Lincoln with great obstinacy and various success, until the middle of September 1779, when the arrival of Count D'Estaing changed the character of the operations and encouraged the allies to undertake the siege of Savannah. This enterprise failed, owing to a hurried and premature attempt to carry the place by storm; but it was conducted with extreme gallantry and only abandoned after heavy losses. The French armament then sailed from the coast, in order to escape the tempestuous season, the approach of which had precipitated their operations.

About the middle of February 1780, an expedition from New York, under the command of Sir Henry Clinton, entered the harbour of Charleston, and it was now evident that overwhelming forces of the enemy were about to undertake the subjugation of the south. After a vigorous and obstinate siege, Charleston fell, notwithstanding the reinforcements forwarded to Lincoln by the American commander; a few trifling skirmishes completed the conquest, and left South Carolina and Georgia in the almost undisturbed possession of the British. Clinton returned to New York in the beginning of June, having entrusted the southern command to Lord Cornwallis with an army of four thousand men.

On the twenty-fifth of July, General Gates assumed the command of the American forces in the South, by selection of Congress. Within one month afterwards, the bloody and decisive battle of Camden destroyed his army, and reduced the war in the Carolinas to a contest of partisans.

The sufferings of the principal army in their winter quarters (1779–80), were again of the most distressing character. In order to preserve the credit of the continental money, congress had resolved that the emission should never exceed two hundred millions: that amount was already expended, and it was now proposed to substitute a system of requisitions of specific articles upon the several states. The commander-in-chief strongly resisted this experiment; for he was fully persuaded that no war could be carried on upon any other than a national basis, and that the quotas of thirteen governments could never be collected when they were really wanted. In the mean time, the troops were reduced first to half allowance, then to less; and finally when the commissary general declared himself without supplies or credit, requisitions were reluctantly issued to the surrounding country. In consequence of these difficulties, the army remained for several successive days without meat, and their pay was five months in arrear, with no early prospect of liquidation. It can be no matter of surprise, therefore, that a mutiny broke out in two Connecticut regiments, which was suppressed with difficulty. The strength of the Americans was thus paralyzed, and the exaggerated reports carried into New York, induced a general belief that they were about to disband. By actual returns made on the 3d of June, the army under Washington's immediate controul included only three thousand seven hundred and sixty men, present and fit for duty—while on the 18th of the same month, by the return of Sir Henry Clinton, the British force in New York counted twelve thousand regulars ready to be employed in the field.

On the 6th of June, General Knyphausen had made a descent upon Elizabethtown, by way of confirming and encouraging the supposed disaffection of the American troops. In this design he was soon satisfied that no success was attainable, and he retired to his place of landing, after exercising much unnecessary severity upon the country and its inhabitants. Clinton resumed the design of offensive operations in New Jersey; but after some severe fighting at Springfield with the corps of General Greene, he also was induced to abandon the project, and to withdraw the British army into Staten Island. The caution exhibited in these operations by the British commander, is perhaps to be ascribed to the intelligence received that a French fleet and army might be immediately expected.

A new impulse was now given to the activity of Congress and of the several states. All felt the necessity of turning the expected succours to the best account, and the most munificent gifts were therefore contributed by patriotic citizens. An engagement had been hastily entered into with the French ambassador, that the troops of his sovereign should be received by an army of twenty five thousand continentals, and that ample supplies for the combined forces should be laid up in magazines. Notwithstanding all the exertions that were made, the arrival of Count Rochambeau and his army at Newport, in the month of July, found the Americans not only unprepared for active operations, but without any certainty as to the strength of the expected forces of the states.

The French General reported himself to Washington as commander in chief, and requested orders with a defined plan of operations. His troops were sent as *auxiliaries*, which, according to military usage, left the post of honour to the Americans. These instructions, so well calculated to preserve the harmony of the allied arms, were given by the King of France at the earnest instance of Lafayette. The natural demand of a sketch of the proposed campaign, exposed Washington to a choice among many difficulties, for it was impossible to decide safely, while his means of action were yet matters of hope and conjecture. The resolution adopted was such as he considered due to the honour of our national engagements. He fixed upon the siege of New York, and designated the 25th of August for the movement of the French. This plan was afterwards suspended, because its essential basis was the possession of maritime superiority, which was wrested from Admiral de Ternay by the junction of the fleets of Arbuthnot and Graves, and the subsequent arrival of Sir George Rodney. The French fleet and army were then blockaded in Newport; while Washington was fully employed in anxious struggles against the accumulating embarrassments of the commissariat, which threatened at every moment to dissolve his forces.

The remainder of the campaign passed away, without presenting any active enterprize. The Americans retired into winter quarters in the early part of December. The Pennsylvania line occupied a station near Morristown; the Jersey troops lay around Pompton; those from New England were stationed on both sides of the Hudson, at and near West Point; and the New York line continued at Albany for the purpose of resisting any movement from the side of Canada.

The summer of 1780 was marked by the famous treaty of *armed neutrality*, in which Denmark, Sweden and Russia pledged themselves to a combined assertion of certain maritime principles, peculiarly obnoxious and dangerous to Great Britain as a naval belligerent. Holland was about to join the alliance, when a declaration of war by the English ministry compelled her to take part among the declared confederates of the United States.

About the same time, the dangerous machinations of private treason were added, in America, to the ordinary perils and difficulties of war. Benedict Arnold, who had won by his courage and fortitude a high place in the esteem of the nation, was entrusted with the important command of West Point. Pecuniary distress, produced by thoughtless prodigality, led a mind but weakly fortified by honourable principle, into the crime of peculation; and the imminent danger of discovery next produced a traitorous correspondence with Sir Henry Clinton. Major John André, an aid-de-camp, to the British commander and adjutant-general of the army, was the instrument employed in this negotiation, the settled object of which was the surrender of the post and the capture of the American garrison. The plan was almost matured, when André, returning from a personal conference within the American lines, was providentially captured, with all his private notes, by three militiamen, who resisted his bribes and promises with patriotic firmness. Arnold immediately took refuge on board the British sloop of war, the Vulture. His unfortunate associate was brought before a court of general officers, where his noble conduct deeply excited the commiseration of the American public. The board, while lamenting the stern necessities of duty, felt themselves compelled to convict him as a spy, and to pronounce the sentence of death prescribed by the usages of war. On no occasion had the commander-in-chief to contend with equal reluctance, than while resolving to sanction the award of the court of inquiry. The public service left no alternative, and his country overcame all inferior considerations.

The chivalrous generosity of Washington's character was exhibited in a small incident connected with these transactions. Mrs Arnold was left by her husband's flight, in the most distressing agonies. Every effort was made to overtake the traitor; but as soon as his escape was ascertained, it was announced to the unfortunate lady in a respectful message. It is honourable to the American character, that at this moment of excitement, Mrs Arnold was allowed to proceed to Philadelphia, to collect her husband's property, and to rejoin him in New York, not only without the least interruption or insult, but with all the assistance that her convenience could require.

In the south, after the decisive victory of Camden, Lord Cornwallis directed his views to the conquest of North Carolina; but his plans were frequently retarded and frustrated by the successes of Sumpter, Marion and other distinguished partisans, and the indomitable courage of the inhabitants. Gates was removed by Congress from the command, which was then assumed by General Greene, on the special appointment of the commander-in-chief. The judicious dispositions of the new general were followed by the rout of Tarlton at the spirited and successful battle of the Cowpens. The efforts of Cornwallis to recover the prisoners and to attack the American army in detail, were foiled by Greene's celebrated retreat into Virginia, where being joined by reinforcements, he found himself strong enough to re-enter North Carolina and to fight the battle of Guilford Court-house. The heavy loss sustained in this action and the scantiness of supplies, compelled Cornwallis to abandon the upper country and finally to retreat to Wilmington on the coast. General Greene, who had hitherto preserved Virginia as the base of his operations, then formed the daring resolution of carrying the war into South Carolina; upon which, after some hesitation, Cornwallis marched upon Virginia, where the traitor Arnold had already landed and commenced his work of invasion and devastation.

The winter of 1780—81, was again devoted by Washington to his regular negotiations with Congress for a better and more secure system of enlistment and subsistence. He obtained at length the vote of an army engaged for the whole war, with the important encouragement of a half pay provision for the officers during life. The sufferings of America would have been greatly abridged had these arrangements been made at the beginning of the contest; but such was the jealousy existing against military power, that no influence less than that of Washington, could have produced their adoption even at this stage of the revolution.

Good measures tardily effected are rarely better than inferior substitutes. In the month of January 1781, the most disastrous consequences were apprehended from a general revolt of the Pennsylvania line and another among the troops of Jersey. The first was appeased by concessions imprudently made by Congress to armed mutineers; the second, produced by the successful impunity of the former, was quelled by the decision and vigorous severity of the commander-in-chief. Sir Henry Clinton endeavoured to turn these movements to the advantage of the royal cause; it was creditable to the soldiers that they immediately arrested the British emissaries, and scornfully rejected all proffer of assistance. The extreme distress of the army and the growing discontent of the people sprang from the same cause; it was the system of forced requisitions, without which no supplies could be obtained for the American forces.

The two armies were so strongly posted, and so nearly equal in point of strength, that no important movements could be effected on either side. The plans of Washington were therefore directed to the south, and to the possibility of striking a decisive blow against the British army in Virginia. Lafayette marched with twelve hundred men to the head of the Chesapeake, and though disappointed in the expected co-operation of the French fleet, he proceeded southward with the utmost celerity, to the seat of war. The royal troops, greatly increased by the arrival of reinforcements, were engaged in over-running the whole state, committing every where the most wanton devastation of private property. The immediate junction of Cornwallis and Arnold, formed an army not to be resisted by the power of the Americans; and Lafayette, after a bold advance, was obliged to fall back. This able retreat was conducted with judgment, and happily effected with a large proportion of his military stores, notwithstanding the exulting boast of the British general, that "the boy could not escape him." General Wayne advanced with fresh troops from the north; and after some sharp conflicts, Cornwallis suspended active operations by retreating to Portsmouth.

If armies could be created by mere acts of Congress, Washington would have found himself at the head of thirty-five thousand men on the first of January; but in point of fact, the Americans were unable to take the field before the month of June, and it was then with a force not exceeding 5000 effectives. The deficiencies in clothing, subsistence, field equipage, &c. were even more distressing. The commander-in-chief fortunately possessed a mind so tempered by nature, as never to rise into extreme confidence, or to sink into the depths of despair. His plans were regularly formed and matured, so as to turn every posture of affairs to the best practical advantage.

When an official communication was received, promising the early arrival of the Count De Grasse with a large naval armament, Washington and Rochambeau resolved to effect a junction and to operate against New York. That city was protected by a force of 11,000 men, under Sir Henry Clinton. The prospect of a decisive blow which would terminate this long and obstinate contest, excited many of the states to new exertions in order to raise the required supplies. Such, however, was the low ebb of public credit, that without the assistance and means of a private citizen, it is more than probable that the active operations of the campaign would have been totally disappointed. That citizen was Robert Morris, a princely merchant, such as few countries have ever possessed, and one who united to immense wealth and credit, the talents and foresight of a statesman.

On the sixth of July, the allied armies met at Dobbs's ferry on the North River. Washington had already begun to apprehend that his great plan was not within the range of possible accomplishment; and he was combining a substitute in rapid movements directed against the southern forces of the enemy. This latter resolution was determined by the arrival at New York of large reinforcements, and the ascertained fact that the arrangements of the Count de Grasse would allow but a short time for co-operation on the coasts of America. Lafayette was ordered to assume such a position as would prevent Cornwallis from retreating to Charleston. He accordingly took post on James River, while the British general fortified himself at Yorktown and Gloucester point, with all his disposable forces. Towards the end of August, the Count De Grasse entered the Chesapeake and landed the Marquis de St. Simon with a strong body of French soldiers. The arrival of the British admiral Graves brought on an indecisive naval battle, which was followed by some movements ending in the return of the British fleet to New York.

Washington's projects, upon the south, were skilfully concealed from the knowledge of Sir Henry Clinton, by a series of manœuvres calculated to keep alive his apprehensions for New York. So dexterously were these executed, that the real design was not suspected until the allies had already approached the Delaware, and were therefore far beyond the reach of interruption. The whole French force, with more than two thousand of the continentals, marched upon this expedition, leaving the defence of the Hudson to General Heath. Sir Henry Clinton then used his utmost exertions to support Cornwallis, both by direct assistance and diversions to the north. One of these latter operations produced the capture and destruction of New London by Benedict Arnold.

After an arrangement had been made for the transportation of the army down the Chesapeake, Washington proceeded to Virginia with Rochambeau, Chastellux, Knox and Du Portail. A personal interview was held with the Count de Grasse on board of the Ville de Paris, where the plan of the allies was fully adjusted. Shortly afterwards, every thing was nearly deranged by the news of reinforcements to the English fleet. The French admiral was excited by a chivalrous eagerness to present himself before the port of New York: but the influence of Washington fortunately overcame this spirit of enterprise and induced him to continue his important co-operation. On the twenty-fifth of September, the last division of the army landed in James River, soon after which the siege of the British position was commenced in form. Including militia, the besiegers numbered about sixteen thousand men.

York is a small town on the southern side of a broad river of the same name, in which a ship of the line can lie in safety. On the north bank, opposite to the town, is Gloucester Point, a long neck of land running far into the river and approaching within a mile of York. These positions were both fortified by the British: the communications being preserved by batteries and several vessels of war. The works at Gloucester point were occupied by 6 or 700 men under Lieutenant Colonel Dundas, who was afterwards reinforced by Tarlton. The main British army lay encamped around York, under cover of outer redoubts and field works. The French general De Choisé was detached with the legion of Lauzun and Weedon's brigade of militia to blockade Gloucester. At their first approach, a brisk action was engaged, in which the British were worsted and compelled to retire within their fortifications.

On the twenty-eighth, the allies advanced by different roads, to occupy the ground fixed upon. The British picquets and cavalry were driven in; and a further movement on the next day, induced Lord Cornwallis to abandon his outer lines. These were occupied by the allies, who now completed the investment. On the night of the sixth of October, the trenches of the first parallel were commenced within six hundred yards of the works: several redoubts and batteries were completed by the 9th and 10th. The fire of the besiegers then became so heavy that scarcely a shot was returned, and the Charon, of 44 guns, with three large transports, was destroyed by shells and red-hot balls. The high spirit of emulation and esteem that existed between the allies, produced the most beneficial effects upon the activity of all operations. On the night of the eleventh, the distance of the belligerents was reduced one half by the commencement of the second parallel; but the fire of the besieged then became destructive from several newly opened embrasures, and particularly from two advanced redoubts. The fourteenth was marked by the simultaneous storm of these two out-works—the one by the Americans under Lafayette—the other by the French troops under the Baron de Viomenil. Not a single shot was returned by the assailants: they advanced intrepidly under the enemy's fire, and entered the works at the point of the bayonet. Washington was particularly gratified with this exploit. In his private diary he observes; "the bravery exhibited by the attacking troops was emulous and praiseworthy. Few cases have exhibited greater proofs of intrepidity, coolness and firmness, than were shown on this occasion." The redoubts were immediately included in the parallel, and the cannon turned on their former masters.

Lord Cornwallis now plainly saw that the fire of the new works would render his position untenable. A sally was attempted for the purpose of destroying two batteries, but the troops were compelled to return without achieving any result. The enterprising commander then formed the daring resolution of crossing the river at night with effectives only—routing De Choisé at Gloucester point—and then pushing by forced marches for New York. This movement was in full progress, when a storm dispersed the boats and returned the British general to his former desperate situation. On the morning of the seventeenth, the garrison beat a parley, and negotiations commenced for a capitulation. On the nineteenth, the posts of Yorktown and Gloucester point surrendered to General Washington, with the garrisons, exceeding 7000 men, and all the military stores. The shipping and seamen were yielded to the Count de Grasse. The loss of the British during the siege was above five hundred; that of the allies about three hundred in killed and wounded.

The intelligence of this important event filled the union with joyous exultation. Public thanks were voted by congress to Washington, the Count Rochambeau, the Count de Grasse, and all the forces employed in the expedition. Trophies were presented to the three commanders as testimonials of gratitude: a marble column was ordered to be erected at Yorktown to the glory of the allied arms, and the thirteenth of December was appointed as a day of general thanksgiving to Divine Providence. State legislatures, corporations and learned institutions presented addresses of congratulation to the commander-in-chief, in which the public veneration for his character was warmly and strongly expressed.

Washington was anxious to secure the further aid of the French fleet in an expedition to be directed against Charleston or Wilmington: but the engagements of the admiral in the West Indies, prevented him from joining in any operations except the transportation to the head of Elk river of the eastern troops under General Lincoln and the cannon of the army. This division was cantoned in New York and New Jersey. The French forces remained in Virginia, so as to be in readiness the next campaign for either a northern or southern movement.

The conquest of York was the crowning glory of the war, and shed its beneficial influences upon every department. General Greene was in the midst of a skilful and active campaign, marked by the sanguinary battles of Hobkirk's hill and the Eutaws, in which the fortune of America was gradually advancing to the ascendant. Wilmington was immediately evacuated by the British, who were now restricted to their posts in the neighbourhood of Charleston and the sea-coast: and civil government was thus again restored to the reconquered state of South Carolina.

Great apprehensions were entertained by Washington, that the glorious achievements of the last campaign would prevent the necessary preparations for the next. His own mind was deeply impressed with the advantages to be derived from a vigorous improvement of the victory. Towards the end of November, he proceeded to Philadelphia; where conferences were held with Congress and the principal officers of the government. The usual difficulties of an empty treasury were to be contended with, and the most judicious efforts produced none but the most inadequate results.

The British nation had now become wearied of a disastrous and expensive war, in which their feelings had never been engaged. The public sentiment reflected in parliament produced a change of ministry, and instructions were issued to the several commanders to desist from offensive operations. Mr. Grenville was sent to Paris for the purpose of treating on the basis of a general peace. These pacific dispositions, combined with the derangement of the American finances, produced in 1782 a campaign of inactivity so far as regarded the main armies of both belligerents. Early in 1783, the definitive treaty of peace was signed, acknowledging the independence of the United States of America.

The disbanding of the army by a government unable to settle arrears, or to furnish one month's pay to transport the soldiers to their homes, was an extremely delicate operation, which could not have been executed without the aid of the high confidence reposed in the commander-in-chief. Some disturbances arose in the line of the army, and a jealous dissatisfaction at the measures of Congress was exhibited very generally among the officers; but all was at length appeased by the decisive weight of character possessed by a single citizen. On the 4th of December, in the city of New York, Washington took leave of his gallant and devoted army. His own emotions on an occasion so interesting, were too strong to be concealed. Tears stood in every eye, and not a word disturbed the solemnity of this sublime spectacle. After he had affectionately saluted all his officers, the war-worn commander embarked in a barge and waved his hat; the assembled veterans answered with the same respectful and affectionate farewell, and returned to their homes in silent melancholy.

Washington then proceeded to Annapolis, in order to resign into the hands of the assembled Congress the power with which he had been invested. The 23d of December was the day fixed for his public audience. The members and an immense crowd of spectators stood uncovered, while the president announced to the American hero, that "the United States in Congress assembled were prepared to receive his communications." With the dignity that belonged to his character and the occasion, Washington delivered a brief address, and returned his commission to the presiding officer. An answer was given, in which the thanks of the nation were strongly and sincerely expressed to him, "the glory of whose virtues was not to terminate with military command, but would continue to animate remotest ages."

Washington retired to Mount Vernon, followed by the veneration and love of his grateful countrymen. In his own language, "he felt himself eased of a load of public care, and hoped to spend the remainder of his days in cultivating the affections of all good men, and in the practice of domestic virtues." His time was devoted to the pursuits and the study of agriculture, the pleasures of intercourse, and the advancement of great works of internal improvement. As president of the Potomac navigation company, he laboured assiduously in this important department of public welfare.

The honours of the country continued to disturb the quiet of his retirement. During several months, affectionate addresses were received almost daily from all parts of the union. Unanimous votes for the erection of his statue were adopted in Congress and by the legislature of Virginia: this state also presented him with one hundred and fifty shares in a public improvement; but faithful to his fixed principles on the subject of recompense, Washington declined receiving the gift, otherwise than as a trust for purposes of general welfare. The society of the Cincinnati, formed by the officers of the late army to preserve the recollection of mutual friendship and suffering, unanimously chose as president their old commander.

With the restoration of peace, the immediate return of individual prosperity and public credit was fondly anticipated. In common with all other intelligent patriots, Washington plainly saw that a closer union of the states was necessary under a federal head. The public obligations must otherwise remain without the duty of justice, and the weak government sinking into anarchy at home, could expect neither consideration nor respect abroad. It was only through the ordeal of suffering, that the states could be brought to abandon their favourite system of individual power; but when at length the calamities of the country—domestic insurrection—high taxes—and general bankruptcy had accumulated beyond endurance, the plan of a convention was reluctantly adopted. The powerful instances of many patriots prevailed on Washington to accept the appointment of a delegate. The weight of his name was felt to be necessary to the important work of laying our national foundations.

Twelve states were represented at Philadelphia at the time appointed, leaving Rhode Island as the single exception. Washington was unanimously chosen to preside over the deliberations of the convention: and in due time their labour was produced and approved as the constitution of the United States. All eyes were then turned upon the citizen of Virginia as the first president of the union, for all acknowledged that without *him* the national experiment had but little chance of success. "It is to little purpose," said Hamilton, "to have introduced a system, if the weightiest influence is not given to its firm establishment in the outset."

On the 14th of April 1789, the unanimous election of George Washington was officially announced at Mount Vernon. "I wish," said the president elect, with that innate modesty which no triumph or homage could ever conquer, "that there may not be reason for regretting the choice; for indeed all I can promise is to accomplish that which can be done by an honest zeal." In his private diary, the memorandum made is full of deep feeling. "About ten o'clock I bade adieu to Mount Vernon, to private life and to domestic felicity, with a mind oppressed with more anxious and painful sensations than I have words to express." His journey to New York which was then the seat of government, was one constant triumphal march. It was everywhere delayed by deputations, addresses, civil processions, military parades, and all the various tributes that could be paid by gratitude to the illustrious American benefactor. On the 30th of April, the ceremony of inauguration was performed in the chamber of the senate, amid the acclamations of an immense multitude.

The great and responsible work was now fairly begun of laying the foundation of a great republic, and of giving action to a government that stood without precedent for its guidance. Bitter political animosities existed which deprived the federal government of that general co-operation so important to its commencement. The constitution itself was far from being secure against the attacks of its numerous enemies; and the whole western country teemed with discontent. In our foreign relations, the seeds of new wars against the Barbary powers, Spain and England, were daily growing more visible. The territory of the United States was actually invaded in several points by large tribes of hostile Indians. The revenue of the union, embarrassed by conflicting interests, and involved in disputed principles, was to be entirely regulated and raised. "It presents to the imagination," said Fisher Ames, "a deep, dark and dreary chaos, impossible to be reduced to order, unless the mind of the architect be clear and capacious, and his power commensurate to the object." The executive departments, with the rules and system of their various operations, were all to be organized and digested. Undaunted by difficulties, Washington bent all his energies to the glorious task. The best abilities of the nation were called to his assistance. The department of foreign affairs was entrusted to Thomas Jefferson, the treasury to Alexander Hamilton; General Knox was secretary of war, and Edmund Randolph attorney-general. The supreme court was composed of distinguished jurists, with John Jay as the chief justice. These were the first officers of Washington, who raised for themselves a monument of fame inferior only to that of their incomparable chief, and who are still referred to in the grateful recollection of an admiring country.

Among the first measures of the new government, were the regulation of the revenue by imports and tonnage—the funding of the national debt, so as to lessen the public burthens consistently with the entire satisfaction of the creditors—and the selection of a future capital for the federal union. The foreign relations of the country, particularly with Spain and Great Britain, whose colonies rendered them immediate neighbours, were subjects of deep interest and attention. The president had soon reason to congratulate the country upon the productiveness of the revenue, the progress of public credit, and the favourable prospects of national affairs.

Treaties were concluded with such of the Indian tribes as could reasonably be conciliated; while active warfare was waged against those who persisted in hostilities. The inadequate means allowed by Congress, delayed for a time that severe chastisement, of which General Wayne was at length the successful instrument. For their permanent pacification, Washington constantly recommended the humane system of gradual improvement, by changing their pursuits to those of agriculture, and by the introduction of a just and well regulated commerce.

A national bank was next established, as an institution important to the prosperous administration of the finances, and of the greatest utility in operations connected with the support of public credit: an excise duty was laid on distilled spirits to meet the increased demands upon the treasury: the regular military force was increased for the protection of the frontiers, and the militia system was placed on an uniform footing. The different opinions prevailing in the country, as to the power and form of the new government, naturally produced conflicting parties: but—except in the darkest times and by the most acrimonious partisans—the character of the president was universally respected, and the purity of his motives was never questioned. The sentiments of both parties were represented in the cabinet by their respective chiefs, while Washington listened as an enlightened judge, far above the suspicion of undue partiality.

1793. As the time approached for a second election of president, Washington was induced by anxious representations, to submit his private happiness once more to the wishes and the welfare of the union. The unanimous votes of the states reinvested him with the first dignity: the vice-presidency was a subject of warm contention between the two great national parties, but John Adams was re-elected by a majority of suffrages.

The troubles and wars of the French revolution, now added largely to the embarrassments of the administration. Sympathy for a gallant ally, who was supposed to be contending against the aggressions of monarchs, for the same freedom which she had aided to establish for ourselves, prevailed among the American people with a degree of ardour that can now be scarcely conceived. It was fortunate for the country, that at this crisis the president was not one to be dazzled by sudden lights or false brilliants. The right of every nation to self-government by institutions of its own choice, to be changed again at pleasure, was our own acknowledged foundation, and therefore not to be denied to others: but there was nothing in this posture of affairs to call the United States from their position of neutrality as an independent nation; and it was Washington's anxious struggle to overcome that colonial feeling, which connected the minds and affections of the American people with the differences of European belligerents. He felt and he knew, also, that a continuance of peace afforded the only chance for consolidating our infant institutions. A proclamation of neutrality was issued for the purpose of preventing all interference by citizens of the United States; while on the other hand, the French minister was received as the envoy of a government existing *de facto*. These measures commenced a system of foreign policy to which we have since inflexibly adhered; at the time, they were not more remarkable for the wise foresight by which they were dictated, than for the noble resistance they opposed to temporary clamour.

The intrigues of the republican minister Genet, a man of talent but of ardent temperament, increased the difficulties of the times. Deceived by the popularity of the French cause, and encouraged by the supposed weakness of the country, he endeavoured to erect himself into an independent power, supported by clubs and numerous adherents, and appealing in case of difference from the government of the union directly to the people. Constant irritations were produced by the equipment of armed vessels and the condemnation and sale of prizes by French consuls, in the ports of the United States. Expeditions were boldly prepared in the south and west for the invasion of Florida and Louisiana by enlisted American citizens. The president at length resorted to the decisive measure of requiring the recall of this turbulent minister. The French government also furnished subjects of grievous complaint to the citizens of the union. Our commerce was harassed by privateers, at least as much as that of the acknowledged enemy. American vessels were detained by a French embargo: and the treaty was violated by their courts of admiralty, whose decrees were often marked by gross injustice and oppression.

The other belligerents contributed their full share to the violation of American neutrality and the excitement of national feeling. Our merchantmen trading to the French colonies, were captured too frequently without any reasonable cause: the rights of search and impressment were every where exercised and abused by British cruisers: regulations were established by arbitrary orders in council that found no authority in the law of war: and an attempt to add famine to the distress of France, materially impeded the American commerce in bread stuffs. England still held a number of military posts belonging to the United States by the terms of the treaty of peace: Spain refused us the navigation of the Mississippi, and both nations were more than suspected of having excited the invasions of the Indians. Such were the difficulties of the American government, exposed to aggression from all abroad, and from temporary excitements, unfortified by the secure bulwark of popular support at home. The numerous party friendly to France regarded any position short of actual warfare with her rival, as ungrateful and dishonourable. The mercantile community loudly complained of their embarrassed commerce: the west threatened disunion because they were barred from the natural outlet of their produce; and the insurrectionary resistance to the excise law in Pennsylvania was only subdued by military force.

In these extremities the position of the president was firm. The necessity for additional warlike preparations was urged upon Congress: "if we desire to avoid insult, we must be able to repel it: if we desire to secure peace—one of the most powerful instruments of our prosperity—it must be known that we are at all times ready for war." The rule of his policy was "to cultivate peace with all the world—to observe treaties with pure and inviolate faith—to check every deviation from the line of impartiality—to explain what may have been misapprehended, and correct what may have been injurious to any nation; having thus acquired the *right*, to lose no time in acquiring the *ability* to insist upon justice being done to ourselves." The American navy was created by this crisis. An embargo was laid on our commerce, taxes were imposed, and all public measures were evidently directed to the approach of war, which, so far as regarded Great Britain, was certainly the popular wish of America.

At this critical period, 1795, the president was deprived of the assistance of his ablest coadjutors. Mr. Jefferson was induced by ill health to resign the secretaryship of foreign affairs; and Hamilton and Knox left their several departments on account of the narrowness of their private fortunes. Edmund Randolph succeeded Jefferson; William Bradford became attorney-general, Mr. Wolcott secretary of the treasury, and Colonel Pickering secretary of war. Mr. Randolph continued but a short time in office: he was succeeded by Pickering, whose vacant department was given to Mr. M'Henry. Upon Mr. Bradford's death, Lee was appointed attorney-general.

The treaty of amity negotiated with England by Jay, was received with the utmost acrimony of opposition by the strong party opposed to all accommodation with an obnoxious power, and by many who conceived it injurious to American interests. Time has now justified the ratification of the executive upon the principles of sound policy; but it was then additionally useful as an adjustment of ancient differences and a commencement of friendly intercourse. A treaty was also effected with Algiers; and by another with Spain, the important points of boundary and the Mississippi were fully conceded. Thus was attained, in the language of Washington, "by prudence and moderation on every side, the extinguishment of all the causes of external discord, which had heretofore menaced our tranquillity, on terms compatible with our national faith and honour;" and thus was laid "the firm and precious foundation for accelerating, maturing and establishing the prosperity of our country." The attention of the government was then anxiously given to the settlement of that system, which, at the present day, is about to produce the extinction of the national debt.

1796. The time again approached for the choice of a President of the United States. The intention of Washington to decline a third election, which had been long known to his confidential friends, now began to be generally suspected. The public work was performed for which alone he had sacrificed the first wishes of his heart. The agriculture and commerce of the nation were flourishing beyond the most sanguine anticipations. Ample revenues had been provided for the support of the government: credit was restored, and the national debt was gradually decreasing. Peace was established with all the world, and with the exception of France, all grounds of foreign rupture had been adjusted by treaty. In all parts of the union—even in those where acts of the administration had been most violently condemned—the warmest attachment and veneration were exhibited for the person and character of the president. It was generally agreed that another unanimous suffrage would again confer upon him the chief magistracy of the nation, when the celebrated valedictory address announced a firm resolution to return to the quiet of a domestic life. In nearly all the state legislatures, resolutions were immediately passed, expressing the deep emotion excited in the people by the intended retirement of one whose services were so exalted and so appreciated.

Washington was present at the inauguration of his successor John Adams, and after receiving new public testimonials of the respect of his fellow-citizens, he turned his steps towards Mount Vernon, "as a wearied traveller who sees a resting place, and is bending his body to lean thereon." His journey was every where interrupted by the usual expressions of affectionate regard.

The retirement of Washington was almost wholly devoted to agriculture, study, and an extensive correspondence. His privacy was frequently disturbed by the addresses of legislative bodies and of his fellow-citizens, for the eyes and memories of all turned without ceasing to the statesman and soldier of America. On only one more occasion did he involve himself in the troubles of public duty. It was when the arrogance of the French Directory threatened immediate war against his beloved country: at that epoch he submitted himself to the public voice, and accepted the post of lieutenant general and commander-in-chief of the armies of the United States. The danger passed away, and harmony was restored in consequence of another change in the government of France.

The hour had now come which was to bear with it the final separation of the illustrious benefactor and his grateful fellow-citizens. A slight exposure to rain on the 13th of December 1799, brought on an inflammatory affection of the windpipe, which in two days produced dissolution. From the beginning Washington was sensible that his death was inevitable, and he only submitted to the exertions of his physicians as an obligation of christian duty. "Doctor," said the expiring hero, "I am dying, and I have been dying for a long time, but I am not afraid to die." He retained until the last moment the full possession of all his faculties. In the strong language of the senate, "favoured of Heaven, he departed without exhibiting the weakness of humanity: magnanimous in death, the darkness of the grave could not obscure his brightness." His affairs were arranged with that serene equanimity which had marked him in all the critical occasions of his great and varied career.

The intelligence of the death of Washington was received by the American people with all that deep and mournful feeling which was due to so great a national calamity. An immense concourse of citizens paid his mortal remains the last earthly honours. The two houses of Congress immediately adjourned. The speaker's chair was shrouded with black, and the members wore mourning during the remainder of the session. Resolutions passed unanimously in honour of him, who was emphatically pronounced, "first in war, first in peace, and first in the hearts of his fellow-citizens." "On this occasion," said the address of the senate, "it is manly to weep. To lose such a man, at such a crisis, is no common calamity to the world. Our country mourns a father. The Almighty disposer of human events has taken from us our greatest benefactor and ornament. It becomes us to submit with reverence to HIM, who 'maketh the darkness his pavilion.' "

A solemn funeral procession took place from the capitol on the 26th of December; on which, occasion, an eloquent oration, prepared at the request of Congress, was delivered by General Lee. The people of the United States wore crape on the left arm for thirty days; and throughout the country, public discourses gave expression to the nation's grief.

The character of Washington has been ably drawn, though with some small shades of difference, by Chief Justice Marshall and Mr. Jefferson. We shall endeavour to combine the two, so as to form a full and impartial sketch.

His person was fine; his stature above the common size and exactly what one would wish: his deportment easy, erect and noble: the best horseman of his age, and the most graceful figure that could be seen on horseback. His constitution was vigorous and capable of enduring the greatest fatigues. The beholder gazed with admiration upon him as

> A combination and a form, indeed,
> Where every god did seem to set his seal,
> To give the world assurance of a man.

The manners of Washington were reserved and dignified without haughtiness. All who approached him felt the indescribable influence of his demeanour, and none ventured upon hasty or undue familiarity. With those in whom he confided he conversed freely, but always with solidity, and never with attempted brilliancy. His attachments were in no case hastily formed; he calculated each man's value, and gave him a sure esteem proportioned to it: in return, the affections of his friends were ardent, but always respectful.

He wrote readily, with ease and correctness, as is exhibited in his extensive correspondence. In his more studied compositions, such as the Farewell Address, his style was clear, powerful, and partaking largely of his native judgment and dignity. His education had been plain, so that all his great acquisitions came rather from action than from books.

Nature had given Washington a high toned and irritable temper, which was habitually restrained by constant watchfulness. It was very rarely that his anger broke bounds, but on those occasions the burst of wrath was tremendous. He was generous, charitable and merciful; a sincere and devout christian, without ostentation or vain exhibition.

His expenditure was honourably liberal, but always exact even to precision. He contributed bountifully to all useful improvements and to the calls of distress, while ill-advised projects and false pretensions met with the severest reprobation. His integrity was the purest, his justice most inflexible: no motives ever swayed his decision beyond the merits of the subject. In the whole of his correspondence and life, Washington presents the extraordinary spectacle of a man and a chief magistrate to whom guile was unknown, whose ends were always just, and means always honest, whose real and alleged motives for every act, public and private, were on every occasion equal and the same.

If Washington possessed the common feelings of ambition, no man has ever so controlled them by reflection and determination. His numerous honours were cast upon him by his fellow citizens, almost against his consent; he accepted them as sacrifices to the public good, and they were regularly laid down after the crisis had passed, as burdens which it had ceased to be his duty to bear. Modesty was with him an innate virtue; and partaking of the general firmness of his mind's texture, it was never even tempted into indiscretion by the praises and homage of admiring millions.

The character of Washington as a warrior is best exhibited by the results of his military career. With the smallest means he attained the greatest ends. Almost always opposed to a superior enemy, he was never surprised, and no decisive victory was gained over his army. How boldly he could strike at the errors and weakness of an adversary, was shown at Trenton, Princeton and York. No general ever planned his battles more judiciously; but, in the opinion of Mr. Jefferson, he was slow at re-adjustment, if any part of his project was suddenly dislocated. Such was Washington's completeness of preparation for all contingencies, that it would be difficult to point out many examples of this deficiency. His most striking characteristic was undoubtedly prudence, never deciding without fully hearing all who were entitled to counsel, and never acting without mature consideration of every difficulty. Of fear he was incapable; his physical and moral qualities placed him far above the reach of such unworthy agitation.

The same qualities which distinguished Washington in the field, followed him into the cabinet of the statesman. His course was calm, advised and firm. He was no *party man*, for he was above any exclusive attachment to individuals or systems, and he had no object but the public good. Distrusting first impressions, he anxiously sought for light; his own judgment was always suspended while doubt remained; but when once fixed, he advanced to his end without regard to consequences. Popular favour was grateful to him, but he would never stoop to retain it by deserving its loss. Whenever duty required, he knew how to hazard all in the dangerous contest with temporary prejudices.

The political opinions of Washington were those of a sincere republican, who anxiously wished the people to enjoy the largest practicable share of self government. Though frequently classed among the *federalists*, we have Mr. Jefferson's testimony that he was no adherent to their party principles. His firm resolution was frequently expressed, that our constitution should have a fair trial, and that in support of it he would spend the last drop of his blood. The sovereignty of good laws appeared to him the first consideration; and he held monarchists and factious demagogues to be equally removed from true patriots.

If the greatness of human character is to be estimated by the solid monuments it has raised, there is no name in all history to compare with Washington's. When it is asked how national independence was achieved—how the sickle of the husbandman could overcome the sword of the soldier—how our distressed armies could escape the foe's superiority, and finally triumph over his pride and power, all point to the valour and Fabian prudence of the commander-in-chief. The inquirer then turns to the birth of the American union, he admires the order that sprang from chaos, the firm foundations that were laid with crumbling materials, and he is again referred to the first president of the United States. To his virtue, firmness and wisdom is due the successful impulse of republican government, the benefits of which, like those of nature's sun, will be felt long after men have ceased to admire its splendour and wonderful conception.

Such was George Washington, "whose character was in its mass perfect, in nothing bad, in few points indifferent; and it may truly be said that never did nature and fortune combine more perfectly to make a man great, and to place him in the same constellation with whatever worthies have merited from mankind an everlasting remembrance." To this eloquent testimonial of Mr. Jefferson, let us add that of his great political rival, John Adams. "The example of Washington is now complete; it will teach wisdom and virtue to magistrates, citizens and men, not only in the present age, but in future generations as long as our history shall be read. If a Trajan found a Pliny, a Marcus Aurelius can never want biographers, eulogists or historians."* LAUSSAT.

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* The reader is referred to the second edition of Chief Justice Marshall's Life of George Washington, lately published with revisions and corrections by the distinguished author. The writer of the present article can ask for his production no higher merit, than that it should be accepted as a faithful summary of the elaborate original.

WASHINGTON, Bushrod, was the son of John A. Washington, Esquire, of Westmoreland county, Virginia, who was the next eldest brother of General Washington. His father was a gentleman of strong mind, and possessed the consideration and confidence of all who knew him. He was, with honour to himself, a delegate in the state legislature of Virginia, and a magistrate of the county in which he resided. Bushrod Washington, his son, received a part of his classical education in the house of the inflexible patriot Richard Henry Lee, under a private tutor; his studies were continued under his paternal roof and afterwards at William and Mary College. At that respectable institution commenced his intimacy and friendship with Mr Chief Justice Marshall, with whom he became afterwards associated in the Supreme Court of the United States; and whose esteem, confidence and respect, he continued to possess, in the fullest extent, to the close of his life.

The invasion of Virginia, by lord Cornwallis, called from their studies, for its defence, the gallant youth of the state, and among them Bushrod Washington, who joined a volunteer troop of cavalry under colonel John F. Mercer, in the army commanded by the Marquis La Fayette. During the whole of the summer he remained in the field, and until Cornwallis had crossed James River. It was then supposed that the invaders intended to move on South Carolina; the troop was disbanded, and its members returned to their homes. In the following winter he came to Philadelphia, and, under the auspices and affectionate care of general Washington, he was placed, as a student at law, in the office of Mr Wilson; a gentleman of great legal learning and high character, and who was afterwards appointed a justice of the Supreme Court of the United States. After completing his studies, he returned to Virginia, and practised his profession in his native county with reputation and success. In 1787 he was chosen a member of the house of delegates of Virginia; and the following year, as one of that body, he assisted in the adoption and ratification of the constitution of the United States by the state of Virginia.

From Westmoreland he removed to Alexandria, a wider sphere for the exercise of his talents as an advocate and a jurist; and he went afterwards from thence to Richmond, and there assumed and maintained an equal station with the gentlemen of that bar; whom to equal, has always been, and continues to be, conclusive, evidence of the highest professional attainments and character.

During his arduous, industrious and extensive practice at the bar in Richmond, and throughout the state, Mr. Washington undertook to report the decisions of the supreme court of Virginia; a work in two volumes, of high authority in the courts of that state, and in those of the union.

He was married in 1785 to Miss Blackburn; he had no children. He was a devoted husband, to an affectionate wife; and such was the strength of her conjugal attachment to her deceased husband, that she survived him but three days.

His high and just reputation as a lawyer, the purity and integrity of his character, and the confidence and respect of the whole community with whom he lived, induced President Adams, in 1798, to appoint him an associate justice of the supreme court of the United States, to fill the vacancy which had occurred by the decease of Mr Justice Wilson. He continued to hold that honoured and honourable station until his death; and presided in the circuit court of New Jersey and in that of Pennsylvania from April 1803, having been in the year 1798 assigned to the circuit courts composing the third circuit.

Judge Washington was the favourite nephew of President Washington, and the devisee of Mount Vernon; the much loved residence of that pure, distinguished and venerated patriot. To Judge Washington he also gave his library, and he also bequeathed to him his public and private papers; at the same time appointing him one of his executors. These high and affectionate testimonials of confidence and esteem must have ever been held in proud possession by him on whom they were bestowed, and by whom they were deserved.

Bushrod Washington held the station of justice of the Supreme Court of the United States for thirty-one years, with a constantly increasing reputation and usefulness. He was a learned judge, whose learning was the result of long continued, laborious services, and comprehensive studies. He was a christian full of religious sensibility and humility. His religion was tranquil, cheerful unobtrusive, meek and gentle. Attached to the Episcopalian church by education and choice, he was one of its most sincere and unostentatious friends.

He died at Philadelphia on the 26th of November 1829, in the 68th year of his age, and his remains were conveyed to Mount Vernon.

At the session of the Supreme Court at January term 1830, Mr Berrien, the attorney general of the United States, moved the court to have the proceedings of the bar and officers of the court, expressive of their high sense of the merits and talents of Mr Justice Washington, entered on the record of the court. Mr Chief Justice Marshall said:

"The sentiments of respect and affection which the gentlemen of the bar and the officers of the court have expressed for the loss of our deceased brother, are most grateful to me, and I can say, with confidence, to all my brethren. No man knew his worth better or deplores his death more than myself; and this sentiment, I am certain, is common to his former associates. I am very sure, I may say for my brethren, as well as for myself, that the application is most gratifying to us all; and that in ordering the resolutions to be entered on the minutes of our proceedings, we indulge our own feelings not less than the feelings of those who make the application."

Immediately on the decease of Mr Justice Washington, the bar of Philadelphia assembled to testify their sense of the loss sustained in his decease by the court and by the nation. Resolutions expressive of their sentiments and feelings were unanimously adopted, and a gentleman of high attainments and station was requested to pronounce an eulogium on the deceased.—*Extracted from an obituary notice of Mr. Justice Washington, in 3 Peters's Supreme Court Reports.*

WASHINGTON CITY

AND

DISTRICT OF COLUMBIA.

WASHINGTON CITY, the seat of the general government of the United States, is situated in the district of Columbia, on the eastern bank of Potomac river, above the mouth of the East Branch, at the head of tide water; it stands on a series of hills of moderate elevation. N. lat. 38° 53′, and long. W. from the Royal Observatory at Greenwich 76° 55½′, and from the Royal Observatory at Paris 79° 15½′ W. The extreme eastern point of the United States, or the eastern point of Manan Island, is, according to Tanner's Map of the United States, 10° 17′ E. of Washington. Upon the same authority, the north point of Queen Charlotte's Island on the Pacific ocean is 55° 56′ W. from Washington City.

The site of Washington is a real basin environed by gently swelling hills, which give it the appearance of occupying the centre of a vast amphitheatre. The soil is generally sterile, admixed with rounded pebbles and sand. If we regard the natural boundaries, we may consider Washington as limited by Rock creek on the N.W., Potomac river S.W. and S.; the East Branch S.E. and E., and on the other side by a range of hills. Length from southeast to northwest four and a half miles, with a mean breadth of two and a half miles, or a small fraction above nine and a half square miles. That part at present occupied by houses, bears but a small proportion to the extent laid out into building lots, with their avenues and streets. The greater part of the buildings are at the navy yard, and along or contiguous to Pennsylvania avenue, including Capitol Hill, the distance being about four and a half miles from East Branch to Rock creek. If compactly built, the whole existing edifices, both public and private, would, it is believed, not occupy more than one mile in length by half a mile in breadth.

That portion of territory composing the district of Columbia, was ceded to the United States by the states of Virginia and Maryland; the ground on which the city stands being within the cession of the latter state. The proprietors of the soil surrendered their lands, to be laid out as a city, and gave up one half thereof to the United States, to be sold to raise funds for the erection of the public buildings.

The plan of the city was formed under the direction of George Washington, then President of the United States, by Pierre C. L'Enfant, in the year 1791.

The positions for the different public edifices, and for the several open squares and areas, as laid down by Andrew Ellicott, were determined on as well for the extensive prospects which they commanded, as by their susceptibility of improvements, either for use or ornament.

Streets running north and south are crossed by others running east and west, whilst those which are denominated avenues traverse these rectangular divisions diagonally, and are so laid out as to afford the most direct communication between those places deemed the most important, and which at the same time offer the most agreeable prospects. Where acute angles are formed by the intersection of the avenues with the streets, there are public reservations which are to be left open, and much of the inconvenience which these intersections would otherwise produce is thus avoided.

The avenues are named after the respective states, whilst the streets are designated either numerically or alphabetically, commencing at the Capitol; those running north and south are designated by the letters of the alphabet—A north, A south, and both extend to the letter W; those running east and west of it are numbered—1st street east, 1st street west; those to the east extend to 31, and those to west to 28.

The avenues and streets leading to public places are from 120 to 160 feet wide; they are divided into footways and carriage ways, and are to have walks divided off by rows of trees; the other streets are from 70 to 110 feet wide; the avenues and streets of 100 feet and upwards have footways of 20 feet; under 100 and over 80 they have footways of 17 feet; streets under 80 feet have 12 feet footways; and the centre of the pumps, hydrants, and trees, on all the streets, must be placed four feet outside of the curb-stone. The principal part of the city was graduated by the surveyors, and recorded, before any buildings were erected; there is now a city surveyor, whose duty it is to give the proper graduations and outlines of lots, as recorded, to persons desirous of building, and for his certificate thereof he is allowed a fee.

The buildings belonging to the United States are: The Capitol, a massy structure of the Corinthian order; it is situated near the western extremity of the Capitol square, 73 feet above tide; it is of free-stone, and consists of a central edifice and two wings, and is of the following dimensions, viz:

Length of the whole front,	*feet*—350.5
" centre building,	120
Height to top of centre dome,	140
Depth of wings,	121.6
East projection,	65
West do.	83
Height of wings to top of balustrade,	70

The wings were nearly completed when the British army, under General Ross, in August 1814, made a sudden incursion, and after defeating the American troops at Bladensburg, gained possession of the city; he set fire to the Capitol, the President's house, and the public offices, reducing them to ashes, although unconnected with the operations of war. The foundation of the north wing was laid in the presence of General Washington, on the 16th September 1793, and that of the centre on the 24th of August 1818, being the anniversary of the destruction by the British. The building covers one and a half acres, and 1820 square feet, exclusive of its circular enclosure and the elegant area and glacis on the west front. The square contains upwards of 20 acres, embracing a circumference of more than three-fourths of a mile, enclosed by a substantial iron railing, with very neat gateways, gravel walks, and a beautiful bordering of shrubbery and flowers, forming a delightful promenade for the use of the citizens. A brick pavement encircles these beautiful grounds.

The Capitol presents the most splendid and imposing architectural mass to be found in this or, probably, in any other country, for the same object. The plan was originally furnished by the late Dr. Thornton, was altered in part by Mr. Latrobe, and finally completed by Mr. Bulfinch.

A magnificent portico, extending the whole length of the centre, decorates the eastern front of the building. The pediment, resting on five massive Corinthian columns, is in just proportion and fine taste. The tympanum is ornamented with an allegorical group, in *alto relievo*, executed by Signor Persico. The principal or central figure, elevated on a platform, represents *America* holding the constitution in her right hand, and directing *Hope*, standing on her left, to look to *Justice*. Near her is an eagle in a soaring attitude. All these figures are colossal, and do credit to the skill of the artist by whom they were executed.

The eastern entrance to the rotunda from the floor of the portico is ornamented with two light and beautiful figures in stone, in the act of covering with laurel the bust of Washington, which is placed immediately over the door.

The rotunda occupies the centre of the Capitol; is ninety-six feet in diameter, and ninety-six feet high to the ceiling of the dome. This is terminated by a cupola and balustrade, accessible by means of a stair-case passing between the roof and ceiling. From this elevation the prospect which bursts upon the eye is most splendid. Three cities are spread before you; the Potomac on one side, and the Eastern Branch on the other, uniting and rolling their waters to the ocean; a range of hills extending in a magnificent sweep around you, and displaying all the richness and verdure of woodland scenery, with here and there beautiful slopes in cultivation; the whole, when coloured by the golden beams of the setting sun, burnishing the reposing clouds, and gilding the tops of the trees, or giving light and shade to the living landscape—forms a scene which few portions of the earth can rival, and which none can surpass. The interior of the rotunda is ornamented with *alto relievos*, sculptured in stone; and with four historical paintings, by Col. Trumbull. Four other pannels are left to be filled up with other productions of the pencil, at some future period. The subjects of the sculptured pannels are, 1st. The landing of the Pilgrims on Plymouth Rock; 2d. The Treaty between Penn and the Indians; 3d. The preservation of Captain Smith by Pocahontas; and, 4th. The exploit of Captain Boon, the western pioneer, with two Indians. The whole of these are indifferently executed, with the exception of the third, representing the Indian princess in the act of saving the life of Smith, which is more skilfully grouped and executed than any of the others.

Stone pilasters support the entablature and cornice, which are ornamented with carved flowers and wreaths, and on the latter are sculptured medallions, representing Columbus, Sir Walter Raleigh, and Cabot: the fourth has not been inserted. The floor of the rotunda, which is laid in Seneca stone, is supported by stone columns of the Tuscan order, and groined arches.

Passing out of this spacious room to the west, you enter the Library of Congress, which is ninety-two feet in length, thirty-four in width, and thirty-six feet high. It consists of twelve alcoves, supporting two galleries running along the whole length of the apartment from north to south, and containing the same number of recesses as the other part of the room. The front of each alcove is ornamented with fluted pilasters, and four stone columns with caps like those in the temple of Lysacrates at Athens. Each end and the ceiling are richly decorated with stucco ornaments, in fine taste. Three circular openings, handsomely ornamented, admit the light from above, while five windows admit light from the west. A stair-way at each corner of the room leads to the galleries above, and a door in the centre opens into a splendid colonnade, or *logea*, to the west, extending the whole length of the apartment.

The Senate Chamber is a semi-circle of seventy-four feet in length, and forty-two feet in height. A light and beautiful gallery projects from the upper part of the semi-circle, and is supported by iron columns and caps, bronzed. The walls are covered with lilac coloured drapery, between pilasters of marble. Columns of *breccia*, or Potomac marble, support the eastern gallery, and the whole is surmounted by a double dome or ceiling, richly ornamented with stucco work; above the eastern gallery, and immediately in front of the president's chair, is placed a portrait of General Washington, five feet by four. It was painted by Rembrandt Peale of Philadelphia; and is said to be the best likeness of that distinguished individual ever executed.

The south wing contains the Hall of the House of of Representatives: ninety-five feet in length and sixty in height; it is a semi-circle, occupying the whole area of the wing from the second story upwards;—twenty-six massive columns and pilasters of breccia or Potomac marble, standing on a base of free stone, support a magnificent dome, painted in a very rich and splendid style, to represent that of the Pantheon of Rome, and executed by a young Italian artist, named Bonani, who died in Washington a few years ago. In the centre of this dome, to admit light from above, is erected a handsome cupola; from this is suspended a massy bronze gilt chandelier, of immense weight, which reaches within a few feet of the floor of the chamber. The speaker's chair is elevated and canopied, and on a level with the logea or promenade for the members, formed of columns and pilasters of marble and stone. Above this and under a sweeping arch near the dome, is placed a colossal figure of liberty; on the entablature beneath is sculptured an American eagle with expanded wings, and in front of the chair, and immediately over the entrance, stands a beautiful statue, in marble, representing History recording the events of the nation. She is placed on a winged car, which is in the act of rolling over the globe, on which is figured in basso relievo the signs of the zodiac; the wheel of the car forms the face of the clock and is finely designed and beautifully executed. The whole was the work of Signor Franzoni, another meritorious Italian artist, who also died in Washington. Between the columns is suspended fringed drapery of crimson morine, festooned near the gallery, to enable the auditors to see as well as hear. A magnificent portrait of Lafayette, at full length, painted by a French artist, and a most admirable likeness of that patriot, decorates a pannel on one side of the logea, and Mr Vanderlin has been employed by Congress to paint a portrait of Washington to occupy the corresponding pannel on the opposite side. Between the columns are placed sofas for the accommodation of those who are privileged to enter the hall; and within the bar, in a semi-circle fronting the speaker's chair, are seated the members of the house, each of whom is furnished with a mahogany desk. These are the principal rooms of the Capitol, with the exception of that occupied by the supreme court, which is immediately under the senate chamber, and nearly of the same form and dimensions.

Near the western entrance, and a few steps from the terrace, is a monument, which formerly stood in the navy yard in this city, originally erected by some of the officers of the navy, as a token of respect to the memory of those gallant youths, Wadsworth, Israel, &c. who voluntarily yielded themselves a sacrifice rather than become the slaves of barbarians. This beautiful little monument was executed in Italy. It is a small Doric pillar with emblematical embellishments, and crowned with an eagle in the act of flying. The column rests on a base sculptured in basso-relievo, representing Tripoli, its fortresses, the Mediterranean, and the American fleet in the fore-ground. The sub-base is of American marble, and at each angle stands an appropriate marble figure spiritedly executed. One of these represents *America*, directing the attention of her *children to History*, who is recording the daring and intrepid action of the young heroes; the third represents *Fame* with a wreath of laurel in one hand and a pen in the other; and the fourth *Mercury*, or the god of commerce, with his cornucopia and caduceus.

The Pennsylvania avenue, planted with Lombardy poplars, leads from the capitol to the President's house, another elegant edifice, built of freestone, according to the Ionic proportions. It is two stories high, with a lofty basement, and is 180 feet long by 85 wide. The entrance from the north is through a lofty portico, which is projected, so as to leave room for carriages to pass between the platform and the outer columns; the house stands on an elevation in the centre of a large reservation of ground; the view to the south is extremely beautiful and picturesque. According to the original design the main front of the building was to the south, which commands a very extensive and beautiful view of the Potomac; but the Pennsylvania avenue, passing on the northern side of the mansion, having become the main thoroughfare of the city, the portico abovementioned has been erected on the northern front, which is thus converted into the principal entrance.

There are four buildings erected 500 feet east and west of the President's house, for the accommodation of the principal departments and subordinate offices of the government. They are each two stories high, with freestone basements, and are covered with slate; the two, facing north, are each 160 feet long by 60 wide, with handsome porticoes of the Ionic order; the two facing south are 150 feet long, by 57 wide.

The general post office, on E street north, occupies the whole of the south front of the square, being 200 feet long; it is 3 stories high, and in it are the general post office, city post office, and patent office; it is a very neat and commodious edifice, well adapted to the purposes for which it is used; it stands on high ground, about equi-distant from the Capitol and the President's house.

The navy yard, on the East Branch, is enclosed on the north and east by a lofty wall, with a handsome gateway and guard-rooms, a large and commodious dwelling for the commandant, and others for different officers attached to the yard; there are extensive timber sheds, warehouses, shops for blacksmiths, coopers, turners, plumbers, joiners, sailmakers, boat builders, &c., a powerful steam engine works two sets of saws, drives a tilt hammer, turners' lathes, &c.; there are also two very large ship houses. The Columbus 64, Potomac and Brandywine frigates, of 44 guns each, and several other vessels of war, have been built at this yard; the neat and tastefully arranged armory and the vast quantity of naval stores, and cannon of every size, deposited in the yard, are objects of much interest.

The marine barracks, situated north of the navy yard, occupy the whole square; the building is upwards of 700 feet in length, with a colonnade facing into the square; in the centre of the square are the officers' quarters; at the north of the square is the commandant's house, which is very large and commodious; and at the south is an armory and workshop; the yard is neat, and kept in excellent order.

A substantial navy magazine, with a house for the keeper and wharf for convenience of receiving and sending off powder, &c., is situated at the east end of the city, on the Anacostia branch of the Potomac.

At the southern extremity of the city stands the extensive army arsenal, and laboratories for arms, and manufactory of military stores, with large sheds and houses for the storage of caissons, cannon, carriages, &c., and a magazine occupying a large space of ground, in a beautiful and commanding situation.

The penitentiary is situated on the public ground north of the arsenal; it is a lofty building, of brick, enclosing within it the cells for the convicts, four tier high, built of freestone, and properly secured by strong iron doors; attached to it are spacious buildings for the warden and keepers; the warden's house faces the Potomac; and in front is a substantial wharf for the convenience of the establishment; the ground is enclosed by a lofty brick wall extending from near the Potomac to James' creek.

Having now completed an account of the most important of the public buildings belonging to the United States in Washington, we subjoin the following summary of expenditures, together with the sources from which a part of the same was raised, and the estimated value of the remaining property, carefully prepared from the most authentic documents:

Expenditures to January 1, 1830.

Purchase of ground for public purposes	38,697 92	
Purchase of stone quarries	30,225 31	
Surveying and marking boundaries	67,469 76	
Opening and improving streets	33,646 82	
Bridge over Rock, Tiber, and James' Creeks	15,041 99	
Building wharves	9,130 17	
Building sheds for workmen	4,681 23	
Digging canal from James to Tiber creek	5,670 61	
Interest on loans, commissions, &c.	165,533 93	
Salaries, &c.	119,906 65	
		490,004 39

Capitol, &c.

Prior to burning in August 1814	788,071 28	
From 1814 to January 1, 1830	1,704,250 27	
Temporary committee rooms	2,771 96	
Enclosing the square	71,602 57	
Alterations in capitol	3,507 84	
Graduating and improving square	20,716 99	
Allegorical clock	2,000 00	
Furnishing committee rooms in centre building	3,579 30	
		2,596,500 21

President's House, &c.

Prior to burning in August 1814	333,207 04	
From 1814 to January 1, 1830	300,072 37	
Alterations on	1,945 63	
Covering the roof	5,405 32	
Erecting walls and gates	5,887 73	
Graduating and improving square	19,009 51	
		665,527 60

Offices.

Prior to burning in August 1814	93,013 82	
From 1814 to Jan. 1830	268,850 68	
		361,864 50
Contingencies between 1814 and 1820	15,673 02	
Engine houses, engines, &c.	12,917 37	
Paved footways	9,064 04	
Purchase of part of the city hall, for court, &c.	10,000 00	
Purch. of Sq. 249 for water	1,246 94	
Jail of Washington county	4,746 20	
Jail of Alexandria county	11,186 03	
Penitentiary of the district	76,127 23	
		140,960 83
		$4,254,857 53

Sources from which the above was raised, and value of remaining property.

Donation from the commonwealth of Virginia	120,000 00	
Donation from Maryland	72,000 00	
Building lots sold	732,717 68	
		924,717 68
5155 lots unsold, at same rate, viz. $180 each		927,900 00
541 acres of reserved ground, distributed in such a manner as to give the United States the possession of some of the most valuable as well as the most beautiful parts of the city, estimated at 10 cents per square foot	2,356,596 00	
Deduct reservations No. 10, 11, and 12, and new squares, A, B, C, D, given up for building lots, and the proceeds applied to levelling the public ground and shifting the canal from the line of Pennsylvania Avenue, to an east and west line from the centre of the Capitol	117,367 70	
		2,239,228 30
Value of wharves, water lots and stone quarries		48,000 00
		$4,139,845 98

For the improvements made in the city, opening and graduating the streets and avenues, the support of the poor, and all other expenses of the city, the money has been raised by assessments upon the private property within its limits; the city lots owned by the United States, the public reservations and all other property of the government, having never been assessed, nor subject to any charge whatever.

The seat of government was established in this city in 1800, during the presidency of John Adams. Legal jurisdiction over the district was assumed by congress on the 27th of February 1801, and the laws of Maryland and Virginia, then existing, declared to be in force, most of which are continued to the present time. The city was first incorporated on the 3d of May 1802, and its charter was modified and its corporate powers enlarged in 1804, 1812, 1820 and 1832. By the present charter the corporation consists of a mayor, aldermen and common council; the mayor and board of aldermen are elected by the people every two years, and the council annually. The mayor and aldermen are justices of the peace ex officio. The city is divided into six wards. Each ward elects two aldermen and three councilmen, and every free white male citizen of the United States, of lawful age, having resided in the city one year previous to the election, and who shall have been assessed on the books of the corporation for the year ending on the 31st December preceding the election, and shall have paid all taxes assessed and due on personal property, when legally required so to do, are entitled to vote for mayor and members of the two boards. The corporation have power to pass all laws for the government of the city, not inconsistent with the constitution or laws of the United States. The judges of the circuit court compose a tribunal for the trial of civil and criminal cases, and the justices of the peace, who are appointed by the president, can give judgment for all sums under fifty dollars, and perform such other duties as usually appertain to that office. There is also an orphans' court and register of wills.

The sessions of the boards of aldermen and council, and also of the circuit court, are held in the City Hall, a spacious brick building, presenting a front of 251 feet. This building, commenced in August 1820, was erected by the corporation from the proceeds of a lottery privilege, granted by congress, but is yet in an unfinished state.

On one side of the same square, originally selected and laid down as the judiciary square, is erected the jail of the county.

To the west of the City Hall stands the Asylum, or Almshouse, erected by the corporation for the reception and accommodation of the poor, diseased, and infirm of the city, for the support of which about four thousand dollars are annually appropriated.

There are four market houses, in each of which market is held tri-weekly; the centre one is large and well supplied, and when finished will form three sides of an oblong square, the south front being open to the waters of Tiber creek.

A little to the north of the city, on a fine elevation, stands Columbia College. This institution was incorporated by congress in 1821. It has 47 acres of land, the building is 117 feet front by 47 wide, and four stories high; besides which, there are two neat dwellings, with out-houses and gardens, for the accommodation of the professors. It has occasionally been aided by congress, but from some defect in the management of its concerns it is not in so flourishing a condition as might have been anticipated from its early prospects and local advantages.

Connected with this establishment is a medical school, which is rising into reputation; the faculty is composed of gentlemen of experience in their profession, and the graduates are well instructed.

Besides many other minor literary establishments, there are in Washington two catholic institutions under the care and direction of the Sisters of Charity, into which orphan females are admitted, supported, and educated gratuitously; pay scholars are also admitted, that the blessings of education may be as widely extended as possible. Nor has the corporation of Washington been indifferent or inattentive to this important subject; it has established two public schools for the free instruction of orphan children, and those of poor and destitute parents, in the elementary branches of English education; these seminaries are under the direction of trustees appointed annually by the city councils, and the number of pupils who are thus gratuitously educated average from three to four hundred. There is also a general orphan asylum supported by voluntary contributions, and for the use of which a very commodious building has been erected.

There are twenty places of worship in Washington, viz. three Episcopalian, four Presbyterian, one Friends, four Methodist, three Baptist, two Catholic, one Unitarian, and two African—generally well attended.

There is also a City Library, incorporated by congress, containing upwards of 5000 volumes. Three banks, with an aggregate capitol of 1,250,000 dollars, and a branch of the United States Bank, a fire insurance company, a museum and gallery of paintings, a colonization society, a society for the abolition of slavery; Bible, missionary and tract societies, Columbian Institute, medical and botanical societies; a lyceum, and several charitable associations.

There are two steamboats which regularly depart from Washington for Baltimore, one to Norfolk, and one to Potomac Creek. Eight stages run daily to Baltimore, one to the west, and several in other directions.

The city is well supplied with good water; the Pennsylvania Avenue is supplied from copious springs, by wooden and iron pipes. West of the Navy Yard are several extensive wharves and warehouses, and others near the Potomac bridge.

The canal which is to connect the two rivers is now under the management of the city, and contracts have been made to enlarge it, both in width and in depth, so as to admit four feet water at low tide; the work has been commenced, and, when completed, will afford sufficient depth of water for a lively trade, in steamboats and small craft, through the centre of the city.

The Anacostia branch has a sufficient depth of water for frigates to ascend above the Navy Yard without being lightened, and vessels drawing fourteen feet can come to the Potomac bridge, and thence to the mouth of Tiber creek, in nine feet water at ordinary high tide; the Tiber itself is shallow, with a soft, muddy bottom, which will be deepened under the canal contract, and from 17th to 14th streets will form a spacious basin of 600 or 700 feet in width by upwards of 1500 in length, to where the canal commences, which is to be 150 wide to 6th street, the whole forming a spacious outlet to the Potomac, and uniting with the Chesapeake and Ohio Canal, which is to be continued from the basin at the mouth of Rock creek.

The assessments for taxes are made once in five years, and in conformity with an act of congress, are to be according to the cash valuation of the property at the time of the assessment. After the payment of its proportion of the general expenses of the city, the taxes raised in each ward are to be expended in improvements therein, and in no other.

The amount of assessments in 1831 were

On personal estate, - -	$634,030
Buildings, - - -	3,384,993
Lots, - - - -	3,488,032
	$7,507,055

The total number of dwelling houses and other buildings on the 31st December 1830 was -	3560
And there were erected in 1831	186
Total in 1831,	3746

The number of inhabitants in Washington were, at different periods, as follows:

	White.	Slaves	Free	Total.
In 1800	2464	623	123	3210
1803	3412	717	223	4,352
1807	4198	944	500	5,652
1810	6292	1,436	892	8,620
1818	——	——	——	11,299
1820	9606	1,945	1,696	13,247
1830	13,379	2,319	3,139	18,837

The number of deaths in Washington for eleven years from 1820 to 1830 inclusive, were 3280, being an average of 298 per annum; the number in 1831 was 380.

Georgetown, also within the District of Columbia, was originally laid out under an act of the colonial assembly of Maryland, passed May 15th, 1751. In 1789, the town was incorporated, and Robert Peter, Esq. appointed first mayor. The corporation is now known by the name of the Mayor, Recorder, Aldermen and Common Council of Georgetown.

This town is situated on the eastern bank of the Potomac river, near the head of the tide and the natural navigation of that river, and is separated by Rock creek from Washington, with which there is a ready communication by means of two bridges crossing the creek at two principal streets of Georgetown, and by a pier of the width of 160 feet, recently constructed across the mouth of Rock creek.

The position of the town is remarkably salubrious, and it has at all times escaped those summer epidemics that have some years prevailed in the adjacent country. It is handsomely situated on a succession of hills, rising gradually from the river and creek, to which all its streets incline, so that every considerable rain thoroughly cleanses them of all impurity.

For some years after the late war a very active business was transacted in the town, and the improvements during this time were very numerous and ornamental. Subsequently, its trade had declined, and improvement in a great measure was suspended. Within the last two years, however, there has been a considerable increase in trade, and several valuable buildings have been erected.

Its principal export trade consists of tobacco, flour, leather, soap, candles, beer, &c. The annual inspection of tobacco varies from 3000 to 5000 hogsheads, and the inspection of flour has increased from 80,000 to 200,000 barrels. There is a considerable foreign trade to Europe, South America, and the West Indies, and an extensive coasting trade.

The Chesapeake and Ohio Canal passes through the heart of the town, at the level of thirty-seven feet above the river, into an extensive basin formed on Rock creek, the descent to which is by four detached locks. This town being the highest seaport on the Potomac, and the first reached by the canal in its descent, its situation is peculiarly favourable for enjoying the trade which will be wafted on that great highway. As a large portion of this canal is expected to be finished and open for navigation during the next season, establishing a ready communication from a rich back country to the basin at Rock creek, a considerable spur to the trade and prosperity of the town may be expected.

The town and its vicinity offers peculiar advantages for extensive manufactories: the river has a fall nearly forty feet in four miles next above the town, and the canal extending over this space at so great an elevation, affords an ample water power for numerous manufacturing establishments, without obstruction to the navigation.

The public institutions and buildings consist of a Roman Catholic College, incorporated by congress—beautifully situated at the edge of the town—it is in a very flourishing condition; a society of nuns, incorporated by congress under the name of the "Sisters of the Visitation," who conduct a flourishing female academy; two Roman Catholic churches, two Protestant Episcopalian, one Presbyterian, one Methodist, one Associated Methodist and one African; two banks, incorporated by congress; and a Lancasterian and several other respectable schools; immediately above the town is an extensive cannon foundry.

The college has been established for 48 years, and not a single death has taken place among the students. The academy under the direction of the "Sisters of the Visitation" has been established for 30 years—only two deaths have taken place among the young ladies. There are at this time sixty young ladies, boarders, and fifteen as day scholars; within the nunnery enclosure, but detached from the academy, and approached from a different street, there is a large establishment for young girls, who are taught gratuitously. At the Lancasterian school, which was the first institution of the kind established upon Lancaster's plan in the United States, there are about 100 boys in the male, and near the same number of girls in the female department. This institution has been in operation about twenty years, and is supported by the corporation under the supervision of a board of trustees incorporated with the name of the "Lancaster School Society of Georgetown;" this is a free-school.

The romantic beauty of the situation, and the close connection of this town with Washington, the seat of the general government, its character for healthiness, its well regulated institutions, and its advantages for commerce and manufactures, if judiciously improved and with becoming enterprise, zeal, and industry, will give to it an imposing distinction, and offer invitations to capitalists of the most alluring character.

Alexandria, a post town and sea port on the western bank of the river Potomac, six miles south of the city of Washington, and 180 miles from the ocean. This town lies principally in the district of Columbia, but a small part of it is in the state of Virginia. It was incorporated in 1779 by the state of Virginia, and that part of it which lies within the district line, was ceded to the general government in 1801. The laws of Virginia enacted previous to that time, still remain in force in the town and county of Alexandria, except those which have been repealed by congress. The municipal government consists of a council of sixteen representatives and a mayor. Four members of the council are annually elected in each of the four wards into which the city is divided, and the mayor is elected every year by the council. The political situation of Alexandria, in common with the other portions of the District of Columbia, is singular. The president of the United States is the governor, and congress the legislature of the district; but, the people of the district have no voice, nor are their sentiments officially heard, in any of the political concerns of the country. The circuit court of the United States for the District of Columbia sits in Alexandria twice a year, and its expenses are defrayed by the general government. From the decisions of this court there are appeals to the supreme court of the U. States.

Alexandria is very handsomely situated. The streets are laid out on the plan of Philadelphia, crossing each other at right angles, and are generally well paved. It is considered as remarkably healthy, and the view from the city is very fine. The town is situated in the bottom of a valley which to the eye of an observer is terminated in every direction by lofty and verdant hills. To the north he sees the city of Washington, the Capitol, with its beautiful columns, white walls and towering dome, forming a most conspicuous object; to the south, the broad translucent expanse of the Potomac opens upon him with fort Washington, lying like a white line on its distant margin opposite to Mount Vernon, the seat of the father of this country. The river opposite to the town is a mile in breadth and varies from thirty-four to fifty-two feet in depth, in the ship channel, which here washes the shore; of course the harbour is naturally very fine, and it has been much improved by the erection of large and commodious wharves.

Alexandria carries on an extensive trade in flour, tobacco, sumach and other articles, with the states of Virginia and Maryland.

The inspections of flour, in

1829 were	168,874 barrels and	5789 half barrels,
1830	166,386	6385
1831	206,394	6001

Besides an extensive trade with the eastern ports of the United States, the exports to foreign countries for the last three years were in amount as follows:—

1829	687,259,
1830	628,142,
1831	864,484.

On the 31st of December 1831, the tonnage belonging to the town was 8230 tons, and it is still increasing. There are four banks in Alexandria, with an aggregate capital of one million seven hundred thousand dollars—and three incorporated insurance companies.

The amount of real estate is assessed at two million seven hundred thousand dollars, and according to authentic information from the treasury department of the United States, the town paid into the treasury from the 31st of December 1791 to the 31st of December 1829 inclusive, on account of customs, three million seven hundred and thirty-seven thousand one hundred and sixty-one dollars and twenty seven cents; on account of the post-office, one hundred and seventy three thousand seventy three dollars and thirty four cents; for direct tax in the years 1815 and 1816, eleven thousand one hundred and fifty dollars and sixty one cents. The amount of internal revenue which cannot be accurately ascertained would swell the clear revenue from the town of Alexandria during the period above mentioned, to upwards of four millions of dollars.

There are in this town two congregations of Episcopalians, two of Presbyterians, one of Friends, two of Methodists, one of Catholics and one of Baptists. There is also a philosophical society, an incorporated library containing about four thousand volumes, a library instituted by an association of apprentices and other minors, a saving fund institution, an orphan asylum, a poorhouse and a dispensary, bible, missionary and temperance societies, a colonization society, a benevolent society for improving the condition of people of colour, a society for furnishing employment to the industrious indigent, and several for supplying food, clothing and fuel to the poor in winter. There are several baking establishments where ship-bread and crackers are made equal to any manufactured in the United States or elsewhere, two shipyards, an extensive brewery, several tanneries, a foundry upon a large scale, with a manufactory of steam engines and various machinery for cotton factories, &c. and several manufactories of segars upon an extensive scale.

Alexandria contains a handsome market house, at which a market is held every morning. It is generally well supplied with meats, fish, fruits and vegetables in their seasons. In the latter part of the spring wild strawberries abound in the adjacent country and are brought in great quantities. Over the market house is the court house, clerks' office, council chamber, reading room and library, and in the upper story of the same building an extensive and well arranged museum. Over the centre of this building is a steeple in which an excellent clock tells the hours on a bell that weighs fifteen hundred pounds.

There is a boarding school for young men, in which are taught the languages, the mathematics, philosophy, and every useful branch of education. A part of the course consists of a series of public lectures on astronomy, chemistry, &c., in which the principles of the sciences treated of are illustrated by experiments with suitable apparatus. The principal of this institution is Benjamin Hallowell, a gentleman favourably known among the learned in science in our country. There is also a boarding school of considerable reputation for young ladies, conducted by a lady, in which are taught all the branches of polite and fashionable education, and a boarding school for young ladies under the charge of four sisters of charity from Emmittsburg in the state of Maryland. This institution, though but lately established and not yet completed, is in a flourishing condition. When finished it will have connected with it an orphans' asylum. There are also in Alexandria free schools for children of both sexes, and about thirty other schools, exclusive of sunday schools.

In the vicinity of Alexandria is established a Protestant Episcopal theological seminary, on an elevated situation, commanding an extensive and delightful view of the District of Columbia, the river Potomac and the surrounding country. This institution at present occupies two large four story buildings, having space enough between them for the erection of a centre structure.

A canal is now in progress which will probably bring a great accession of business. This canal is designed to continue the Chesapeake and Ohio Canal to Alexandria, and will be connected with that great work by a splendid aqueduct, thrown across the river Potomac, immediately above Georgetown. The perpendicular descent from the surface of the river, above the Little Falls to tide water, is about thirty-six feet, and as the canal will be brought on a level from the head of the Falls to Alexandria, it is obvious that at the latter place, it will afford water-power for manufactories to a very great extent. Towards the construction of the Alexandria Canal, the government of the United States have appropriated one hundred thousand dollars. This city is connected with the interior of the state of Virginia by several turnpike roads, down which the principal part of the flour is brought that comes to market, and there are eight steamboats, that regularly ply between this and other ports, five of which arrive and depart daily.

As Alexandria is the shipping port of the District of Columbia, and one of the principal marts for the immense fisheries of the Potomac, it may be well to mention, that in the spring of the year, quantities of shad and herring are taken, which may appear almost incredible. The number of shad frequently obtained at a haul is forty thousand and upwards, and of herring vastly more. In the spring of 1832 there were taken in one seine, at one draught, nine hundred and fifty thousand and a little upwards, accurately counted. The prosecution of the numerous fisheries gives employment to a large number of labourers, and affords an opportunity to the poor to lay in at very reduced prices food enough to last their families the whole year. The shad and herring of the Potomac are transported by land all over the country, whence there is convenient access to the river, and they are also shipped to various ports in the United States and West Indies. The lowest prices at which these fish sell when just taken, are twenty-five cents per thousand for herring, and one dollar and a half per hundred for shad, but they generally bring higher prices, often one dollar and a half per thousand for the former, and from six to twelve dollars per hundred for the latter. Herring, however, are sometimes taken so plentifully that they are given away or hauled on the land as manure, for want of purchasers. Some idea may be formed of the importance of these fisheries, from the following statement:

Number of fisheries on the Potomac, about	150
Number of labourers required at the landings,	6500
Number of vessels employed,	450
Number of men to navigate these vessels,	1350
Number of shad taken in a good season, which lasts only about five or six weeks,	22,500,000
Number of herring under similar circumstances,	750,000,000
Quantity of salt required to cure the fish,	Bushels 995,000
Number of barrels to contain the fish,	995,000

Should the Chesapeake and Ohio Canal be continued to the Ohio River, it is obvious that the fisheries of the Potomac will be of great advantage to the country west of the Allegheny mountains in supplying in great abundance a delicious and valuable article of food, of which its waters are entirely destitute. Taking into view the vast number of fish annually caught, and the probable increase in the demand for them, one might be led to fear that the supply will at length be exhausted, however ample at the present time; but when we reflect that the spawn from an exceedingly small number will generate into myriads and myriads of fish, such a fear is done away.

The River Potomac, in the neighbourhood of

Alexandria, and for a considerable distance below that city, is frequented in the winter season by immense flocks of wild ducks of several species, particularly the highly esteemed *canvass back*. In the morning and evening they fly up or down the river in an almost continuous flock for hours. At night, or in the day, a listener in a favourable situation may hear at intervals the distant report of the ducking gun, and then the roar of the flock, as they flap their wings in the water, attempting to rise, which sounds like distant thunder. Ducking is a source of profit to many persons, as they obtain generally from fifty cents to one dollar per pair for the canvass backs.

The District of Columbia having no local legislature, but being under the exclusive jurisdiction of the government of the United States, is dependant upon congress for all general enactments intended to improve its condition, and its interests have been much neglected, or postponed, in consequence of the pressure of higher objects, embracing the interests of the whole nation; of this the citizens of the district have complained, and that with much apparent reason. At the close of the session of 1832, however, large appropriations were made for internal improvements within the district. The Macadamizing of the Pennsylvania Avenue from the Capitol to the President's house, a distance of nearly two miles, has been undertaken at the national expense. The long bridge crossing the Potomac, and leading from Washington city to the Alexandria road, was destroyed by the ice in the year 1830; this structure belonged to a private company, but as the stock was unproductive, its funds would not enable them to rebuild it, its length being upwards of three-quarters of a mile. A new one is ordered to be erected at the public expense, and is, of course, to be a free bridge. The appropriations made for these purposes amount to about 200,000 dollars, and for their completion additional sums will hereafter be granted. The rebuilding of the long bridge must be considered as an undertaking truly national, as it makes a part of the direct main mail route through the United States; since its destruction the mails passing between Washington and Alexandria have been compelled to make a considerable circuit.

The population of the District of Columbia, according to the census of 1820 and 1830, were as follows:

1820	Whites	Slaves	Free Col.	Total.
City	9606	1945	1696	13,247
Georgetown	4940	1526	894	7,360
Washington Co.	1512	1049	168	2,729
Alexandria	5615	1435	1168	8,218
Alexandria Co.	941	422	122	1,485
	22,614	6377	4048	33,039
1830				
City	13379	2319	3232	18,930
Georgetown	6058	1175	1209	8,442
Washington Co.	1727	999	267	2,993
Alexandria	5681	1201	1381	8,263
Alexandria Co.	802	366	177	1,346
	27647	6060	6266	39,973

NOTE.—In preparing the account of Washington City, I have been indebted to the politeness of George Watterston, Esq. from whom the description of the Capitol was principally obtained; much information was also derived from an article prepared by John Sessford, Esq. and published in the "National Callendar" for 1832. The accounts of Georgetown and Alexandria were principally obtained from gentlemen resident in those towns.—EDITOR.

WASHINGTON, southeastern county of Maine, bounded by Passamaquoddy bay S.E., Atlantic Ocean S., Hancock county in Maine S.W., Penobscot county N.W., and St Croix river separating it from the British province of New Brunswick E. It is difficult to estimate the true extent, as the county stretches indeffinitely to the northward, but the southern and settled parts occupy a surface approaching a square of 50 miles each side; area 2500 square miles. Extending in Lat. from 44° 23′ to 45° 20′ N., and in Long. from 8° 46′ to the eastern side of Manan Island 9° 16′ E. The slope shown by the course of the streams is southeastward; the ocean coast excessively broken by bays and islands of the bays advancing from the westward.

Dyer's bay separates Hancock from Washington. Pigeon Hill bay receives the small river Nanaguagus. Pleasant bay, a small river of the same name. Englishman's bay is followed by Machias bay, the latter receiving Machias and East rivers. These bays, in a distance of 40 miles, penetrate the country from 10 to 12 miles, and such is the rapid declivity, that, excessive as is the tide along the coast, the flow does not ascend the short rivers far above the head of the bays.

From Machias bay the coast inflects from N.E. by E. to N.E., and in a distance of 30 miles to the mouth of Eastport bay is unbroken by any inlet of consequence. Turning Quoddyhead, in the strait between Great Manan Island and the main shore, Eastport bay opens. This latter is an irregular sheet of water, extending its arms to 10 or 12 miles on every side. One of these arms reach into St Andrew's bay, or the inner recess of Passamaquoddy bay. Into the head of St Andrew's bay is poured the much celebrated St Croix river, forming the northeastern boundary of the United States on the

Atlantic Ocean. The mouth of this river being an important political point, it may be well to observe, geographically, that N. Lat. 45° and Long. 10° E. from W. C., intersect in the southern side of St Andrew's bay, or the estuary of St Croix.

The features of Washington, Maine, are varied by the bays and small islands along the coast, and by internal lakes. At the foot of the lower falls of St Croix, the Schoodic river enters from the west. This stream is the outlet of a chain of lakes called the Schoodic lakes, extending into Penobscot county, and almost touch the Pesadumkeag lakes of the Penobscot river, and thus almost insulate the inhabited part of Washington county. Population in 1820 was 12,744; in 1830 it had risen to 21,294.

Machias, the seat of justice, stands on the point between Machias and East rivers, about 10 miles within the outer capes, by post road 143 miles a little N. of E. from Augusta, the capital of the state, and 745 miles N.E. by E. from W. C. It is about 25 miles S.W. from Eastport. N. Lat. 44° 43', Long. 67° 21' W. from London, and 9° 34' E. from W. C.

WASHINGTON, county of Vermont, bounded by Orange county of the same state S.E. and S., Addison S.W., Chittenden W. and N.W., N. by Orange, and N.E. and E. by Caledonia. Length from S.W. to N.E. 26 miles; mean breadth 20, and area 520 square miles. Extending in Lat. from 44° 05' to 44° 32' N., and in Long. from 4° to 4° 40' E. from W. C.

The eastern border of this county, in common with Caledonia, is a chain of mountains, from the western flank of which issues numerous sources of Onion river. These sources mingle their waters with other streams from the mountain valleys on both sides, but the main channel flowing to the northwestward gives that declination to the surface. The country is indeed nearly commensurate with the higher part of the valley of Onion river. It may be, however, well to observe, that though the general slope is N.W. that the counter valleys between the mountain chains are at nearly right angles to that direction. The face of the county is very greatly diversified by hill, dale, valley and the most rugged mountain scenery. The soil is as varied as the physiognomy, but generally productive in grain, grasses, pasturage and fruit. Population in 1820 was 14,113; and in 1830 had risen to 21,378.

There is, perhaps, no point in this county at which the arable surface does not exceed an elevation of 500 feet above the Atlantic Ocean, whilst the higher margin at the extreme sources of Onion river exceeds a relative height above tide of 1300 feet. In effect or temperature at least two degrees of Fahrenheit may be allowed for the mean height of the county. If, therefore, we allow a central Lat. of 44° 15', the real aerial temperature of 46° 15' must be taken when compared with the ocean border.

Montpelier, the seat of justice of the county and of the government for the state, is situated on the right bank of Onion river, 25 miles N.N.E. from Middlebury, 25 miles N.W. by W. from Haverhill in New Hampshire, and by post road 524 miles N.E. from W. C. N. Lat. 44° 16'. Population, 2500.

WASHINGTON, the southwestern county of Rhode Island, bounded S.W. by Paucatuck river, separating it from the southeastern part of New London county, Connecticut; W. by the extreme eastern part of New London county; N.W. by the southeastern angle of Windham county, Connecticut; N. by Kent county, Rhode Island; by the western arm of Narraganset bay separating it from Newport county, and by the Atlantic Ocean S.E. and S. Extending in Lat. from 41° 17' to 41° 39'; and in Long. from 5° 06' to 5° 35' E. from W. C. It approaches to near a square of 18 miles each side. Area 324 square miles.

The eastern part declines towards Narraganset bay, but the central, western and northern sections are drained by the main stream and confluents of Paucatuck river. The surface is agreeably broken into hill and dale, and soil productive. Population in 1820 was 15,687; in 1830, 15,411.

Kingston, or South Kingston, the seat of justice, is situated on the Atlantic Ocean, about three miles S.W. from the mouth of the western arm of Narraganset bay, 10 miles S.W. by W. from Newport, 41 miles a little N. of E. from New London, and by post road 31 miles a very little W. of S. from Providence. Lat. 41° 25'; Long. 5° 32' E. from W. C. In 1820, this county contained a population of 15,687.

WASHINGTON, county of New York, bounded S. by Hoosack river separating it from Renssalaer county of the same state; S.W. by Hudson river separating it from Saratoga county, W. by a line running a little W. of due N. from the great bend of Hudson at Sandy Hill to Lake George, separating it from the southeastern part of Warren; N.W. by Lake George separating it from the northeastern part of Warren; N.E. by Rutland county Vermont; and E. and S.E. by Bennington county Vermont. Length from south to north, and from Hoosack river to the outlet of Lake George, 64 miles; mean width 13, and area 832 square miles.

This lengthened county occupies the very remarkable physical section between the basin of Hudson and Lake Champlain, along which extends the Hudson and Champlain Canal. This region and the important work upon its surface, have been already noticed in different parts of the article United States. The space along which the Hudson and Champlain canal has been constructed, though connecting two physical basins, is a deep valley when compared with the adjacent country on either side. The arable surface of the country along the canal is elevated above the Hudson tides from 150 to 200 feet, but rapidly rises to the eastward towards the mountains of Vermont. The surface is greatly varied from the bottoms along the Hudson and the level of the canal, to the rugged elevations between which flow the channels and confluents of Hoosack, Batten Kill, and Parlet rivers. Extending in Lat. from 42° 53' to 43° 50', the difference of latitude alone gives a sensible difference of climate. The soil is varied, but the general character is that of fertility. In 1820, the population amounted to 38,831; and in 1830, had risen to 42,635, giving an augmentation of nine per cent, and at the latter epoch a distributive population of a fraction above 51 to the square mile.

From its great length there are two places, Sandy Hill and Salem, at which the courts of justice are held; and beside at these, there were in 1831, post offices at Adamsville, Anaquascook, Argyle, Battenville, Buskirk's Bridge, Cambridge, Centre Cambridge, Coothill, Dresden, Easton, Fort Ann, Fort Edward, Fort Miller, Granville, Greenwich, Griswold's Mills, Hampton, Hartford, Hebron, Jackson, Kingsbury, North Easton, North Granville, North Greenwich, Patten's Mills, Putnam, South Hartford, West Hebron, White Creek and White Hall.

Salem, one of the villages at which courts are held, is situated near the eastern border of the county, N. Lat. 43° 08′, Long. 4° 44′ E. from W. C., 20 miles S.E. from Sandy Hill, and by post road, 46 miles N.N.E. from Albany, and 423 miles N.E. from W. C. The township of Salem in 1830, contained 2972 inhabitants.

Sandy Hill, in the township of Kingsbury, is rendered at once interesting and romantic from its position on the left bank of Hudson river on an elevated plain near Baker's Falls, 50 miles a little E. of N. from Albany, and by post road 427 miles N.E. from W. C. Below this fine village the Champlain Canal is connected with Hudson river. In 1820, the township of Kingsbury contained 2203 inhabitants, and in 1830, 2606.

WASHINGTON, one of the extreme western counties of Pennsylvania, bounded N.W. by Beaver; N.E. by Allegheny; E. by Monongahela river, separating it from Westmoreland and Fayette; S. by Greene; S.W. by Ohio county Virginia, and W. by Brooke county Virginia. Length along the Virginia line 38 miles; the greatest breadth at right angles to the length about 37 miles, but the county narrowing towards the eastern border, the mean breadth is about 26 miles. The area in round numbers may be assumed safely at 1000 square miles, extending in Lat. from 29° 58′ to 40° 30′, and in Long. from 2° 52′ to 3° 35′ W. from W. C. This county is traversed from south to north by the dividing ridge between the sources of creeks flowing eastward into the Monongahela, and westward into Ohio. The central part contiguous to the borough of Washington, is a real mountainous table land, from which the waters flow like radii from a common centre. From here issue the sources of Ten Mile, Pigeon, Chartier, Buffalo and Wheeling creeks. The borough of Washington, situated in a comparatively deep valley, is, by actual measurement, found to be elevated above tide water 1406 feet, and the mean elevation of the farms in that neighbourhood is at least 1400 feet; many of them no doubt from 200 to 300 feet above that level. The village of Willsborough, on the United States road, 12 miles S.E. by E. from Washington, is elevated 1750 feet above tide water, and 1072 feet above the ordinary river level at the city of Pittsburgh. The lowest cultivated farm or flat part of the county between the mouth of Mirgo creek and Elizabeth Town on the Monongahela, is at least elevated 850 feet above the tide level of the Atlantic Ocean. Three degrees of Fahrenheit may be assumed as a moderate allowance for the change of temperature over the mean surface of Washington county, arising from difference of level; consequently, if we assume 40° 14′ as the central latitude, the winter climate would accord with 43¼° nearly, on the Atlantic ocean. The difference of inflorescence and foliage in the spring, and of ripening of grain and fruit in summer and autumn is strikingly perceptible between the table land of Washington county and the borders of Monongahela and Ohio rivers. These vegetable phenomena are usually ascribed to soil, but the true and efficient cause is relative level. In fact much of the soil on the table land is fully equal to that on the rivers.

The surface of Washington county is very much broken by hill and dale, and some parts so much so as to deserve the title of mountainous. The prevailing rocks are freestone and deep blue limestone, the formation floetz; consequently all the rocks lie in horizontal strata. Though freestone and limestone are the most abundant, they are not the only components of rock strata in this county; soapstone is frequent, but always excessively laminated.

Bituminous coal of very fine quality is the only valuable fossil which abounds, but that inflammable body is found in immense strata over the county, and no doubt exists in easily accessible situations to an unsuspected extent. The bituminous coal, here, as elsewhere over the Ohio valley, lies in horizontal strata, between masses of freestone and beds of clay. The coal strata varies in thickness, but of pure combustible coal; the beds are seldom above four and a half or five feet. When found, the coal stratum is invariably continuous on its level, and is never found to terminate unless pursued to open day on the opposite side of the hill in which it occurs.

The soil of Washington county varies in quality, but its general character is that of fertility. Prevailing timber, white oak, black oak, poplar (*Liriodendron tulipifera*), sugar maple, red maple, hickory three or four species, and various other species of trees. Dogwood (*Cornus sporida*), is a common underwood; wild plum, and two or three species of thorn, abound along the creek bottoms. In the early settlement of this county, the hazel was very abundant.

The adaptation of the soil to farming may be strongly illustrated by showing the advance of the population. The first effective white settlements were made about 1770, and in 1800 it contained 28,298 inhabitants; in 1810, 36,289; in 1820, 40,038; and in 1830, they had risen to the number of 42,909, or upwards of 42 to the square mile.

Washington, the seat of justice, and in which is located Washington College, is situated near the centre of the county, near the head of the middle branch of Chartier's creek, 25 miles S.W. from Pittsburgh, 31 miles N.E. by E. from Wheeling in

Virginia; 229 miles N.W. by W. from W. C., and 312 miles a little N. of W. from Philadelphia. N. lat. 40° 11′, and long. 3° 19′ W. from W. C. Though elevated 1406 feet above tide water, as stated in the previous article, the village is environed with hills which rise to a considerable elevation above any part of its streets. From the highest eminences about two miles eastward, and along the United States road, Chestnut Ridge, though distant 40 miles, is distinctly visible over the deep valley of Monongahela.

The streets of the town are laid out at right angles to each other, the main street pursuing a gentle acclivity for some distance, and thence sweeping over the head of a valley. This street is rather closely built, and contains the greater part of the population. The college edifice stands over a small valley to the east of the village. In 1830, by the census returns, this borough contained 1816 inhabitants. It was founded by the Hoge family in 1781.

The United States road passes through Washington, entering it from the eastward, and winding out at the northwestern side. It is also connected with Pittsburgh by a turnpike road; which passes through Cannonsburg, seven miles from Washington, and eighteen from Pittsburgh.

Cannonsburg, the seat of Jefferson College, stands on a steep acclivity, rising from Chartier's creek, seven miles below Washington. The village is in great part comprised in a main street ascending the hill from the creek. The college, a large brick edifice, stands on the eastern side of the main street. The country around Cannonsburg is highly fertile, picturesque and pleasant. The two colleges of Washington and Jefferson, however, though located in delightful and healthful situations, are too near each other for their mutual benefit. In 1830, Cannonsburg contained 673 inhabitants.

WASHINGTON, one of the western counties of Maryland, bounded W. by Allegheny county of the same state; N.W. by Bedford county Pennsylvania; E. by South Mountain, as there called (*Blue Ridge*), separating it from Frederick county Maryland; and by Potomac river, separating it from Jefferson and Berkeley counties of Virginia S., and from Morgan county Virginia, S.W. The greatest length along the southern boundary of Pennsylvania 44 miles. The breadth varies greatly, as along the Blude Ridge the width exceeds 30, whilst at Hancock's town it falls short of three miles; the mean width is about and over 440 square miles, extending in Lat. from 39° 19′ to 39° 42′, and in Long. from 0° 26′ to 1° 18′ W. from W. C. Traversed by three chains of mountains, the slope of this county is very nearly due S. and in that direction is drained by the Antietam, Conecocheague, and numerous smaller creeks flowing in that direction. The surface is very broken, particularly that of the western part, above the Kittatinny range of mountains, but the soil of the valleys excellent. The eastern part between the Kittatinny and Blue Ridge, comprises a part of the great limestone range which falls from, and flanks the latter chain on its north-western side. The valleys of Antietam and Conecocheague are noted for the production of grain and fruit.

Progressive population—	1790	-	15,882
	1800	-	13,650
	1810	-	18,730
	1820	-	23,075
	1830	-	25,268

Hagerstown, the seat of justice, stands near the western bank of Antietam creek, 68 miles N.N.W from W. C., 25 N.W. from Frederick, and 72 miles N.W. by W. from Baltimore. N. lat. 39° 39′, and long. 0° 42′ W. from W. C. By the census of 1830, this place contained 3371 inhabitants. It is a prosperous and well built town, and the third in size on the western shore of Maryland.

Hancockstown, on the left bank and at the extreme northern bend of Potomac, 24 miles a little N. of W. from Hagerstown, is a small, but neat village in a delightful situation on the main western road.

Williamsport, also on the Potomac and on the high point below the mouth of Antietam, is in point of population and wealth the second town in the county. The site and environs are peculiarly picturesque. The powerful mill stream of Antietam and a limestone soil contribute to the prosperity of this place.

Should either or both the Chesapeake and Ohio canal and Baltimore and Ohio rail-road, be extended up the Potomac the lines of extension will stretch along the Potomac margin of this county and pass both Williamsport and Hancockstown.

The lowest part of the cultivated surface of this county exceeds an elevation of 300 feet above tide water, and in the higher part near Hancockstown, upwards of 450 feet. It is probable that the mean height of the arable soil exceeds 500 feet, or more than an equivalent to a degree of latitude. The effect of difference of level at the extremes on both the temperature of the air and on vegetable life is very perceptible.

WASHINGTON, county of Virginia, bounded W. by Scott, by Clinch mountain separating it from Russellon N.W., and Tazewell on the N., by Wythe county E., by Blue Ridge separating it from Grayson on S.E., by Carter county in Tennessee S., and Sullivan of Tennessee S.W. Length between Wythe and Scott counties 50 miles, mean breadth 17, and area 850 square miles, extending in Lat. from 36° 35′ to 36° 55′ N., and in Long. from 4° 30′ to 5° 19′ W. from W. C. This county occupies part of the valley between Blue Ridge and Clinch mountains. These chains extend in this region from S.W. by W. to N.E. by E. with minor lateral ridges. The slope of this county is to the S.W. by W. and traversed by the S.E. middle and north branches of Holston. All those streams have their source in Wythe, and subdivide Washington into as many fine fertile valleys. It may, however, excite some reflection when told that in this large and well populated county, there were in 1831 but two post offices, Abingdon, the capital, and Seven Mile Ford. Population in 1820, 12,444, in 1830, 15,614.

By the post list of 1831, Abingdon, the seat of justice, is stated at 385 miles S.W. by W. from W. C., and 309 S. of W. from Richmond; it is situated at the S.E. side of a mountain ridge about mid-distance between the two main branches of Holston river, and about seven miles distant from each on the great valley road, N. Lat. 36° 41′, Long. 5° 65′ W. from W. C.

WASHINGTON, county of North Carolina, bounded by Tyrrell E., Hyde S., Martin W., and Albemarle sound N. It lies in form of a parallellogram 20 miles by 18, area 360 square miles, extending in Lat. from 35° 40′ to 35° 56′ N., and in Long. from 0° 12′ to 0° 38′ E. from W. C. What very little declivity this county presents is from S. to W. towards Albemarle sound, but the surface is nearly a dead level, and in most parts swampy. Chief town, Plymouth. Population in 1820, 3986, in 1830, 4552. Plymouth is situated on the S. side of Roanoke river, near Albemarle sound, 18 miles S. of Edenton, Lat. 35° 51′ and Long. 0° 16′ E. from W. C. By the post list of 1831, this place is distant 128 miles almost due E. from Raleigh, and 290 miles E. of S. from W. C. Population in 1830, 662.

WASHINGTON, sea port, post village and seat of justice, Beaufort county North Carolina, situated on the left bank of Tar river, at or near the point where that stream assumes the name of Pamlico sound, by post road 122 miles a little S. of E. from Raleigh, and 202 miles almost directly S. from W. C. N. Lat. 35° 32′, Long. 0° 63′ W. from W. C. Washington is at the head of such ship navigation as Pamlico sound will admit of, and having the fine valley of Tar river in the rear, is a place of considerable note.

WASHINGTON, county of Georgia, bounded N. W. by Baldwin, N. by Hancock, N.E. and E. by Jefferson, S.E. by Emanuel, S.W. by Laurens, and W. by Oconee river, separating it from Wilkinson; extending in Lat. from 32° 42′ to 33° 13′, and in Long. from 5° 36′ to 6° 11′ W. from W. C. Though bounded on the westward by Oconee, this county is a table land. It is bounded on the N. E. by the main stream, and gives source to several confluents of Great Ogechee, this section falling to the southward. The general declivity is nevertheless to the southward, discharging creeks into Oconee. Much of the soil is good, some excellent, but in general thin. The greatest length is from the southern angle or Oconee to the northern or Great Ogechee, 38 miles, mean breadth 20, area 760 square miles. Population in 1820, 10,627, in 1830, 9820.

WASHINGTON, post village and seat of justice, Wilkes county Georgia, situated 51 miles W.N.W. from Augusta, and by post road 64 miles N E. from Milledgeville. N. Lat. 33° 42′, Long. 5° 45′ W. from W. C. This place contains an academy and about 800 inhabitants.

WASHINGTON, county of Florida, as laid down on Tanner's U. S., is bounded on the N.W. by Choctawhatchie bay and river, separating it from Walton county, on the N. by Jackson county, E. by Appalachicola river, separating it from Gladsden county, and S.E. and S.W. by the Gulf of Mexico. Length from the entrance of Choctawhatchie bay to the north of Appalachicola river 110 miles, mean breadth 22, and area 2420 square miles, extending in Lat from Cape St. George 29° 20′ to 30° 40′ N. and in Long. from 8° to 9° 36′ W. from W. C.

Williams, in his View of West Florida, speaking of this county, says: "It is a misshapen tract of worthless land in general; a few Lammocks on St. Andrew's bay, the south edges of Oak and Hickory hills, a part of Holmes valley, and the borders of the Econsina river are valuable exceptions." St. Andrew's bay opens into and occupies the central parts of this county, and is a fine sheet of water, which, according to William's Map, has 18 feet water on its shallowest bar. Chief town, Holmes valley.

WASHINGTON, county of Alabama, bounded by the Chickasaw Lay river separating it from Wayne county of the state of Mississippi, W., by the Chocktaw territory, Alabama, N., by Tombigbee river separating it from Clarke county, Alabama, E., and by Mobile county, S. The greatest length is along the eastern border 42 miles by the general course of Tombigbee river, the mean breadth is about 20 miles, area 840 square miles, extending in Lat. from 31° 23′ to 32° N. and in Long. from 11° 3′ to 11° 37′ W. from W. C. The mere western border of this county is in the valley of Chickasaw Lay river, but the far greater part slopes to the eastward, towards Tombigbee river. Chief towns, Washington and St. Stephens. Population in 1830, 3474.

WASHINGTON, parish of Louisiana, bounded by Pike county Mississippi, N.W., Maria county Mississippi, N., Pearl river separating it from Hancock county Mississippi, E., St. Tammany parish Louisiana, S., and Tangipao river, separating it from St. Helena parish of Louisiana, W. Greatest length, a diagonal from the S.E. to N.W. angle, 66 miles, mean breadth 15, area within a small fraction of 1000 square miles; extending in Lat. from 30° 34′ to 31° N., and in Long. from 12° 36′ to 13° 34′ W. from W. C. The declivity of this county is to the S.S E. and in that direction it is bounded by the Pearl E., and Tangipao W. The Bogue Chito, rising in Laurence and Pike counties, Mississippi, traverses Washington parish, which, also giving source to Chifuncte river, discharges the former into Pearl river and the latter over St. Tammany into the north side of Lake Pontchartrain. The far greatest part of the surface of Washington parish is composed of open and sterile pine woods. Where the land admits cultivation the staple is cotton. Chief town, Franklinton. Population in 1820, 2517, in 1830, 2286.

WASHINGTON, post village, Adams county Mississippi, situated on St. Catharine creek, six miles E. from Natchez. This place was many years the seat of government for the Mississippi territory, and afterwards for the state of Mississippi. Jefferson College was located here in 1802, but has not flourished as a literary institution beyond the ordinary routine of a common academy. The site of the town is high, dry and pleasant, WASHINGTON, north western county of Arkansas, as laid down on Tanner's U. S., is bounded W. by the Osage territories, and N. by the state of Missouri. The extent on the map exceeds 3000 square miles, but the country is too imperfectly known to admit detailed description. By the list of 1831, there were three post offices, namely, Cane-hill, Fayetteville and Vineyard: neither of which are marked on the map. The extreme sources of White river are delineated as rising near the centre and flowing north-eastwardly out of this county into the state of Missouri, and from the latter curving back into Arkansas.

WASHINGTON, county of Tennessee, bounded by Greene W., Sullivan N., Carter E., and by Blue Ridge separating it from Buncombe county North Carolina, S. Length from S. to N. 30, mean width 20, and area 600 square miles. Extending in Lat. from 35° 57′ to 36° 24′, and in Long. from 5° 10′ to 5° 35′ W. from W. C. A small section of this county slopes to the northward and is drained by small creeks flowing into Watauga river, but the southern, central and much most extensive sections, are commensurate with the higher valley of Nabachucky river, and slope south-westwardly. Chief town, Jonesborough. Population in 1820, 9557, in 1830, 10,995.

WASHINGTON, county of Kentucky, bounded W. by Hardin, N.W. by Chaplin's Fork of Salt river separating it from Nelson, N.E. and E. by Mercer, S.E. by Casey, and S. by the south fork of Salt river. Length 28, mean breadth 18 and area 500 square miles. Extending in Lat. from 37° 30′ to 37° 52′ N., and in Long. from 7° 58′ to 8° 32′ W. from W. C. Comprised within the two main branches and drained by numerous creeks of Salt river. Chief town, Springfield. Population in 1820, 15,947, in 1830, 19,130.

WASHINGTON, post village and seat of justice, Mason county, Kentucky, situated four miles from Ohio river at Maysville, and by post road 63 miles N.E. by E. from Frankfort, N. Lat. 38° 37′, Long. 6° 43′ W. from W. C. It contains, beside the county buildings, an academy and three or four places of public worship.

WASHINGTON, one of the south-eastern counties of Ohio, bounded by Athens S.W. and W., Morgan N.W., Monroe N.E., Ohio river separating it from Tyler county Virginia, on the E., and Ohio river, separating it from Wood county Virginia, S. Extending in Lat. from 39° 15′ to 39° 40′ N., and in Long. from 4° to 4° 54′ W. from W. C. Length on the northern border along Monroe and Morgan counties 50 miles. It lies in a rude resemblance to a triangle, mean breadth 15, and area 750 square miles. The slope is southward, towards the Ohio river. The Muskingham enters the northeastern angle, and winding thence eastward to near the centre of the county, inflects to the south, and falls into the Ohio river at Marietta. The surface of this county is generally very hilly, but soil productive. By the post list of 1831, besides at Marietta, the county seat, there were offices at Belpre, Bents, Brown's Mills, Carroll, Fearing, Little Hockhocking, Lower Salem, Newport, Point Harmar, Reigne's Mills, Waterford, Watertown, and Wesley. Population in 1820, 10,425, in 1830, 11,731.

WASHINGTON, county of Indiana, bounded S. by Harrison, S.W. by Crawford, W. by Orange, N.W. by Lamena, N. by the E. Fork of White river, separating it from Jackson, N.E. by Scott, E. by Clark, and S.E. by Floyd. Length from E. to W. 26, mean breath 20, area 520 square miles. Extending in Lat. from 38° 27′ to 38° 47′, and Long. from 8° 54′ to 9° 20′ W. from W. C. This county extends southwardly from the bank of the east branch of White river, over the table land between that stream and Ohio river; Blue river, a small confluent of Ohio, rises in and drains the southern part, whilst from the western flow small creeks into the E. Fork of White river, surface broken, hilly, and fertile. Chief town, Salem. By the post-office list of 1831, besides at Salem, there were offices in this county at Claysville, Livonia, Martinsburg, and Pleasant Valley. Population in 1830, 9039. Salem, the county seat, is situated near the centre of the county, 91 miles S. from Indianapolis. N. Lat. 38° 36′, Long. 9° 08′.

WASHINGTON, county of Illinois, bounded S. by Perry, S.W. by Randolph, W. by St. Clair, N. by Clinton, and E. by Jefferson. Length from E. to W. 36 miles, mean breadth 18, area 540 square miles. Extending in Lat. from 38° 13′ to 38° 30′, and in Long. from 12° 10′ to 12° 44′ W. from W. C. Kaskaskia river forms a part of the northwest boundary of this county, separating it from Clinton, and the slope of the contiguous part is northwestward towards that stream; the southern side declines to the southward, and gives source to the northwestern branches of Muddy creek. In 1831, by post list, there was no office at Nashville, the county seat, but there were at Beaucoup, Covington, and Elkhorn. Covington is a post village on Kaskaskia river, 47 miles a little S. of E. from St. Louis in Missouri, and by post road 40 miles S.S.W. from Vandalia. Population in 1830, 1675.

WASHINGTON, county of Missouri, bounded by Madison, S.E., St. Francis county E., Jefferson, N.E., Franklin N., and as laid down on Tanner's Map, by territory not laid out into counties on the S. and W. Length, from S. to N. 40, mean width 25, and area 1000 square miles. Extending in Lat. from 37° 35′ to 38° 10′, and in Long. from 13° 36′ to 14° 08′ W. from W. C. This county, as delineated by Tanner, has a natural boundary on the S. by the Iron mountains, from the southern slopes of which and the border of the county, rise the extreme sources of St. Francis and Black rivers. The body of the county, however, declines almost due north, and is drained by the fountains of both main branches of Merrimac rivers. The tract of country embraced by Washington county is an important section of the state of Missouri. The intelligent Henry R. Schoolcraft, who visited the lead mines at and contiguous to Potosi, speaks thus of the country: "Washington county, although the seat of the principal lead mines, is at the same time not deficient in farming land. Big River, (the eastern branch of Merrimac), in its whole course, which is long and devious, and most completely subtends the north, east, and south boundaries of Washington county, affords the finest of farming lands. The principal farming tracts of this county, which, although detached with ridges of poor land intervening, yet, taken in the aggregate, bear a respectable proportion to its whole number of square miles, and exalt its agricultural character above that of the mining counties (of Missouri), St. Genevieve excepted. Bellevue abounds in granite and iron ore. The iron of Bellevue, is a subject of universal notoriety. In the richness of the ore and extent of the beds or mines, it is no where paralleled. The most noted place is called the Iron mountains, where the ore is piled in such enormous masses as to constitute the entire southern extremity of a lofty ridge, which is elevated 500 or 600 feet above the plain." Mr Schoolcraft denominates the species of iron ore to be called micaceous oxyde of iron, and very rich in quality. This author enumerates zinc, also, amongst the minerals of Washington county, but lead was the (1819) only ore worked to any great amount, if we except three salt-petre caves. In 1831, by the post-office list, beside at Potosi, the county seat, there were offices at Caledonia, Harmony, and Old Mines; Potosi, the seat of justice, is situated on a branch of Big River, about 60 miles S.W. from St. Louis, 40 W. from St. Genevieve, and by post road, 127 miles, S.E. by E. from Jefferson, the seat of government of the state. N. Lat. 37° 36′, Long. 13° 48′ W. from W. C. Population in 1830, 6784.

WASHITAU, or, according to French orthography, Ouachitau, a river of Arkansas and Louisiana. The most remote sources of this river, its three main branches of Little Missouri, Washitau proper and Saline, are in the southeastern valleys of the Masserne mountains in the southwestern part of Arkansas.

Little Missouri, the southwestern branch of Washitau, rises in Clarke county, Arkansas, between the sources of Saline branch of Red river and those of Washitau proper. Flowing thence to southeastward between Clarke and Hempstead counties, joins the main or middle branch at N. Lat. 33° 45′, and about 60 miles a little east of south from the Hot Springs.

Washitau proper rises between the sources of Little Missouri and those of the Saline branch, and by several confluent streams pursues a general course a little east of south 70 miles to its junction with Little Missouri. Below the union of the two branches, the main volume, now at high water a navigable river, inclines to S.E., and by a very tortuous channel, but comparative course of 55 miles, receives the Saline from the north.

In length of course the Saline at their junction about equals the Washitau, but falls short in magnitude of volume. The Saline has its remote sources about 30 miles westward from Little Rock or Arkansas, from which point pursuing a direction of a little east of south by comparative courses 120 miles, falls into Washitau at N. Lat. 33° 10′; and what is rather remarkable, the course of the Saline is maintained by the united waters in all the residue of their course to Red river.

Below the influx of Saline, Washitau flows southward 35 miles to the entrance of Bayou Bartheberry from the northeast, and of the Saluter from the northwest. The Bartheberry is a stream of 140 miles comparative course, rising within two or three miles from the main channel of Arkansas, in Jefferson county, territory of Arkansas. Flowing thence by an elliptic curve to the eastward, but without receiving any tributary streams of consequence, traverses Chicot county, Arkansas, and entering Louisiana, falls into the Washitau river in the parish of Washitau. Saluter is a large pine woods creek rising in Lafayette county, Arkansas, and flowing S.E. enters Louisiana and falls into Washitau a short distance below, but on the opposite side from the influx of Bartheberry.

Out of the Bartheberry, about three miles from its junction with the Washitau, issues a creek, called in the country Bayou Siard, which winding about 15 miles, falls itself into the Ouachitau, forming an island of 10 or 12 miles in length, with a breadth of 100 to 405 miles. Nearly opposite to the lower end of the Siard island comes in from the northwestward the Terrebonne river. This latter is a most limpid and beautiful pine forest stream interlocking sources with those of the Saluter, and those of Dacheet branch of Red river, and by a comparative course of 75 miles to the southeast, falls into the Washitau.

Below Siard island the now fine volume of Washitau inclines to S.S.E. by very tortuous individual bends, but by comparative course of 50 miles to the entrance of Boeuf river from the north. The latter, similar to all the northeastern confluents of Washitau, rises within a few miles from the main channel of Arkansas, and pursuing a southern course between the Mississippi and Bartheberry 65 miles, enters Louisiana, in which, inclining to the S.S.W. 85 miles, joins Washitau at N. Lat. 31° 52′. The Boeuf, for the first and highest half of its course, is distant about from 15 to 20 miles from the Mississippi, and is annually swelled by the superior flood of the vast volume of the latter. This swell, as indeed that of all the lower confluents and main stream of Washitau, is occasioned, not by an influx of water from the Mississippi, but from a back water flood produced by the filling of the low lands, and preventing the outlet of the streams of Washitau and Boeuf.

With the influx of the Boeuf, the Washitau assumes a southern direction by comparative course 20 miles to its very remarkable reception of the Tensaw from the northeast, and of the Ocatahoola from the southwest. The meeting of these three streams at one point, and the peculiar features and phenomena of the Ocatahoola, gives great interest to the scene.

Tensaw river is formed by the drain of the immense flow, and annually inundated, though densely wooded plain between the Mississippi and Washitau rivers. The highest source, if that term in its common acceptation is here applicable of the Tensaw, is about N. Lat. 33°, and the northern boundary of Louisiana, issuing from Grand Lake, a former bend of the Mississippi. Flowing thence about 100 miles comparative course of S.S.W., and receiving the Masson, a considerable branch from the low grounds between it and the Boeuf, joins the Washitau as already stated.

Within less than half a mile below the entrance of the Tensaw, the Ocatahoola enters from the opposite direction. This latter has its remote sources in the pine forests between the Washitau and Red river, interlocking fountains with those of the Terrebonne branch of Washitau and those of the Lower Saline branch of Red river. Flowing thence to S.S.E. by comparative courses 80 miles, reaches the verge of the great plains of the Delta. Here the Ocatahoola discharges a small outlet which continues the general course to Red river; but the main volume bends abruptly to the northeast, and in seasons of high water spreads into a lake of 20 miles in length, and with a breadth of from one to five or six miles; and again contracts into a river of about 100 yards wide, continuing to the N E. to its union with the Washitau. At seasons of high water in Louisiana the Ocatahoola lake and river becomes nearly stagnant, but as the great flood of the Delta abates, the current into Washitau augments until the lake of Ocatahoola disappears, and a muddy stream wandering over an immense meadow succeeds. This meadow again, as the flood of the succeeding year commences, receives the reflux of Ocatahoola river *from* the Washitau, and gradually fills; and thus, alternately, the lake and meadow take place of each other, and the intermediate Ocatahoola flows towards or from the Washitau, according to the state of inundation or draining of the Delta.

With the augmentation of Tensaw and Ocatahoola, Washitau looses its name in that of Black river, which, with a very crooked channel, but general southern course of 30 miles, merges in the larger volume of Red river, at N. Lat. 31° 17′, and 14° 55′ W. Long. from W. C.

The valley of the Washitau extends from N. Lat. 31° 17′ to 34° 45′, or in round numbers, over three and a half degrees of latitude; the greatest length from the Red river to the sources of Saline is 250 miles along a course a very little west of north; mean breadth at least 80, and area 20,000 square miles. It is a region presenting great diversity of feature, soil, climate, and of vegetable and mineral production. The higher sources rise amidst mountains in part clothed with timber, and in part presenting naked rocks or grassy plains. On one of its higher branches, at N. Lat. 34° 34′, and 16° W. from W. C. gush forth one of the most remarkable fountains of *hot water* known. The adjacent country, rich in scenery and richer still in a most salubrious atmosphere, and innumerable fountains of pure cool water, is now known as Hot Spring county, Arkansas. The springs and village which has risen near them are situated, according to Tanner's U. S. Map, 47 miles a little S. of W. from Little Rock, the seat of government for Arkansas, and about 300 miles a little E. of N. from Natchitoches in Louisiana.

The writer of this article resided in Louisiana when the celebrity of those springs first rose, and has known several instances of unequivocal benefit to health derived from a visit to them, and their use while there. But conversing with intelligent physicians and others, some of whom founded their opinion on personal experience, one common principle seemed to be acknowledged: that is, if we suppose all other circumstances the same, any pure spring water heated to a like temperature and used in the same manner for the same time, would be equally efficacious. "Pure air from mountain scenery, exemption from their ordinary cares, and a more temperate regimen, in most cases are the true sources of cure," said one. All their attendant advantages cannot, however, be easily brought into combined action, if we suppose such a combination possible on the wide spread monotonous regions to the southward; therefore the Hot Springs, it is probable, will at all future ages afford a most salutary and delicious summer retreat, not alone to the sick and lame, but to every one who can afford the expense of a visit.

Muriate of soda (common salt), and, it is said, gypsum, abound in the Washitau valley. The soil, if taken generally, is far from productive, and a great proportion is indeed sterile. To these asperities some strong exceptions exist. Along the lower Washitau and its confluent streams, tracts of first rate land are found. The same observations may be made respecting partial sections over the whole valley; but they are partial exceptions.

Where the land is capable of culture, particularly in Louisiana, cotton, Indian corn, and the sweet potato are the common vegetables cultivated; the former as the staple for market. The peach and yellow fig abound. Wheat, rye, oats, and meadow grasses have been attempted, but with only partial success.

The main Washitau is completely navigable at high water for any requisite vessel, far above Louisiana. When thus swelled, it is rather a rapid, but otherwise safely navigable stream. With the head of Siard island high land ceases on the left bank, if we except a solitary elevated tract called Sicily island, about midway between the mouths of the Boeuf and Tensaw. On the right side, or western bank, hills of considerable elevation stretch to near the influx of Boeuf. Those hills, in some states of the atmosphere, are distinctly visible from the Bluffs in the vicinity of Natchez, though between 30 and 40 miles of inundated plain lies between.

WASHITAU, north-eastern parish of Louisiana, bounded by Tensaw river, separating it from Concordia, S E., by Ocatahoola parish S., Natchitoches S.W., Clairborne W., and Lafayette, Union and Chicot counties of Arkansas N. Length from east to west, 90 miles, mean breadth 50, and area 5400 square miles. Extending in Lat. from 31° 48′ to 33° N. and in Long. from 14° 15′ to 15° 46, W. from W. C. This comparatively extensive region, exceeding in extent some of the states of the United States, is entirely comprised within, and except the mountainous part, presents an epitome of the whole Washitau valley. The main volume of the Washitau river enters its northern side and traverses the whole parish in a nearly southern direction, dividing it into two not very unequal sections, and receiving within its limits the Saluter and Terrebonne from the right, and the Bartheberry from the left. The Siard island is very near the centre of the parish. The eastern section is traversed from northeast to southwest by the Boeuf. From the southwestern angle issue some of the higher sources of Ocatahoola. The general slope being southward. With but little exception, the section west of the Washitau river is covered with a fine forest; the surface waving and soil rather sterile. To the latter character there are exceptions along the streams. On the eastern side above and eastward of Bayou Siard island, pine woods again commence and extend to the Tensaw, with the low grounds of the Boeuf intervening. The south-eastern part reaches the annually inundated extremes of the Delta.

Small, and some of them very fertile prairies are dotted over the north-eastern section, but the nineteen-twentieths of the whole parish, in its natural state, was covered with a dense forest, great part of which remains untouched by the hand of man. Settlements are, however, extended over every part where any arable soil is found, and along the truly productive soil of the Washitau fine farms are cultivated to advantage.

By the post office list of 1831, there were offices at Monroe, Caldwell's, Hamilton, Lake Providence and Pecan Grove. In 1820 the population amounted to 2896, and in 1830, to 5140, having gained in ten years at a ratio of 180 per cent.

Monroe, the seat of justice, is a village on the east bank of the Washitau river, about two miles below the lower extreme of Bayou Siard island, by post road 1258 miles S.W. by W. from W. C., and 323 miles N.W. from New Orleans. In direct distance, Monroe is N.N.W. 80 miles, but by the road via the junction of Tensaw and Ocatahoola with the Washitau, about 120 miles from Natchez. N. Lat. 32° 30′, Long. 15° 12′ W. from W. C.

WASHTENAW, county of Michigan, bounded N.W. by Ingham county, N. by Shiawassee, N.E. by Oakland, E. by Wayne, S.E. by Monroe, S. by Lenawee, and S.W. and W. by Jackson. Length from S. to N. 36 miles, mean breadth 30, and area 1080 square miles. Extending in Lat. from 42° 06′ to 42° 39′, and in Long. from 6° 32′ to 7° 08′ W. from W. C.

From the northwestern border issue, and flowing northwardly, the extreme sources of Shiawassee river, one of the branches of Saginau. Huron river of Lake Erie, rising in Oakland, flows southwestwardly into Washtenaw, forms a sweeping curve towards the centre of the county, and thence bends to S.E. into Wayne. The southern side is drained into the river Raisin. The surface of Washtenaw is level; indeed much of it a real flat. General slope, slight however, is to the eastward. The western border extends along the table land between Lakes Erie and Michigan, and give source to the extreme branches of Grand river of the latter.

By the post office list of 1831, there were offices in this county at Ann Arbour, Dexter, Dixborough, Lodi, Saline and at Ypsilanti.

Ann Arbour, the seat of justice, is situated on Huron river, by the post road 535 miles N.W. by W. from W. C., and 42 W. from Detroit. N. Lat. 42° 17′, Long. 6° 38′ W. from W. C. Population of the county, 4035 in 1830.

WATAUGA, river of North Carolina and Tennessee, rises in Ash county of the former state, from the northwestern valleys of Blue Ridge, opposite to the sources of Catawba and Yadkin, and interlocking sources with those of New River branch of Great Kenhawa. These higher creeks of Watauga flowing to the W. by N.W., traverse the Iron mountains and unite in Carter county, Tennessee. Carter county is indeed very nearly commensurate with the lower valley of Watauga, in the western angle of which the various branches unite, and entering Sullivan, fall into the S.E. branch of Holston. DARBY.

WATCH. See HOROLOGY.

WATERA, local name given to the Catawba river in the lower part of its course in Kenshaw, Richland and Sumpter districts, South Carolina. See Catawba and Congaree rivers. DARBY.

WATERWORKS. See HYDRODYNAMICS and NAVIGATION, *Inland.*

WATERS, COLOUR OF. See PHYSICAL GEOGRAPHY.

WATERS, MINERAL. See MINERAL WATERS.

WATER BELLOWS. See HYDRODYNAMICS.

WATERFORD, a maritime county of Ireland, in the province of Munster, is separated by the Suir from Kilkenny and Tipperary, by the Blackwater from Cork on a part of its west boundary, by the sea on the south, and on the east by the harbour of Waterford, which separates it from Wexford. It is about 51 miles long and 30 broad, and contains 710 square miles, or 454,400 English acres. Its political divisions are the liberties of the city of Waterford, and seven baronies, including 74 parishes and 21 churches, which are divided between the sees of Waterford and Lismore.

This county is generally hilly, and is particularly rugged and mountainous in its northern part. The Knockmeledown mountains occupy the west of the county, forming a very elevated ridge on the north of the Blackwater. The Commeragh mountains occupy a great space between Dungarvon and Clonmell. With the exception of a few barren and rugged spots, these hills afford good pasture. On the south and east of the county, the land is rich and productive. The farms are in general small; though some of the dairy farmers in the neighbourhood of Waterford pay 1000*l.* of rent per annum. A great deal of butter is made in the mountainous districts, where small cows form the principal stock. There are few sheep, and these are not good, and a small part of the land is under tillage. Lime is so dear that it costs £.5 to lime an acre. Furze is so much used as fuel, that it is raised as a crop for that purpose. The largest property in the county is that of the Duke of Devonshire. Leases are generally for 21 years.

The principal rivers are the Blackwater, which is navigable to Cappoquin. The Bride, which joins the Blackwater, passes near Tallow, and is so far navigable. The majestic Suir, which rises in Tipperary, flows almost due east, when it enters this county, till it joins the Barrow and the Nore beyond the city of Waterford, when flowing southerly, they form the harbour of Waterford, which is an estuary nine miles long and two broad. The wooded banks of the Blackwater and the Suir, and their tributary streams, are singularly beautiful, and adorned by many ancient castles and modern residences.

The principal towns in this county are Waterford, Lismore, Dungarvon and Tallow. WATERFORD and LISMORE are described in separate articles. Dungarvon is an old seaport town, with narrow and dirty streets. Forty or fifty coasting and fishing boats belong to the place. The ruins of the old castle of the Augustinian priory still remain. It sends a member to the imperial parliament. It is frequented for sea bathing. Tallow or Tallagh is a decayed village containing a barrack, and at the west end of the bridge the ruins of Lessfinny castle. The village of Tramore, a few miles south of Waterford, is much frequented during the bathing season.

Waterford county sends two members to the imperial parliament.

In 1791, the population of this county was 110,000, and the number of houses 18,796. In 1821, the population was 127,679. The Protestants bear a small proportion to the Catholics, and most of the landed and personal property is in the hands of the Catholics. The celebrated Boyle was born in the castle of Lismore, and also Congreve, whose father was agent to the Boyles, from whom the Duke of Devonshire, as the oldest branch of the family, derives his property in the county. See Beaufort's *Memoir of a Map of Ireland*, and Wakefield's *Statistical Account of Ireland*, passim.

WATERFORD, a city and seaport town of Ireland, and the capital of the county of the same name, is situated on the south side of the river Suir, and is a handsome town. The cathedral, which has been lately erected, is a fine structure with an elegant steeple. The episcopal palace is also a noble building of hewn stone, with a double front. Besides the cathedral, there are three parish churches, four Roman Catholic chapels, and places of worship for the Society of Friends and other sects. The other public buildings are highly ornamental to the city. The most important are a fine court-house, jail, exchange, custom-house, theatre, coffee-house, and assembly-rooms. It has also a house of industry, and a poors' hospital, and many other liberally supported charities, which owe much of their success to the never failing charity and benevolence of the Society of Friends, who are very numerous in Waterford.

The manufactures of this town are flint glass and salt. Linen, cotton, and coarse woollen goods are made in other parts of the county. Waterford carries on a considerable trade with England and the interior of Ireland, as well as with other countries. A few years ago, it had no less than 70 vessels employed in the Newfoundland trade. Its inland trade is greatly facilitated by an extensive inland navigation by means of the Barrow, Nore, and Suir. The harbour of Waterford is deep and spacious, and is defended by Duncannon fort. The quay, is about half a mile long, and there is a wooden bridge across the Suir, which forms a communication with Wexford and Kilkenny. The principal exports of Waterford are beef, butter, hides, tallow, pork and corn. The number of large hogs slaughtered weekly during the season, exceeds 3000 at an average; and in 1809 they where estimated as worth £.1,000,000 sterling. The butter exported annually exceeds 80,000 casks. The annual value of agricultural produce exported, has been estimated at £.3,000,000 sterling. Population 26,787.

WATERFORD, formerly Le Bœuf, situated on Le Bœuf creek, Erie county, Pennsylvania, 15 miles a little E. of S. from the borough of Erie, 100 miles very nearly due N. from Pittsburgh, and by post road, 333 miles N. W. from W. C. At seasons of high water, a down stream navigation is practicable from this place. Population in 1820 of the township 570, in 1830, 554. Population of the borough, exclusive of the township, in 1830, 1000.

DARBY.

WATERLOO, BATTLE OF. See FRANCE.

WATERSPOUT. The phenomena of this meteor have been described in our article PHYSICAL GEOGRAPHY, and various references to the account of individual phenomena have been added. Although various kinds of waterspouts have been observed since that article was written, yet no satisfactory explanation of the phenomena has been discovered. M. Bosson has recently observed some phenomena connected with the waterspout, which have not been seen before. One of the most remarkable effects which he noticed, was that in the direction taken by the waterspout, the trees put out new blossoms, a circumstance which he attributed to the privation of leaves, an elevation of temperature, and the humidity of the atmosphere. The following conclusions are deduced by M. Bosson:

1. The action of the waterspout showed itself in a valley.
2. Its direction continued always the same, in spite of the hills and valleys over which it passed.
3. The elevation of the ground rendered its effects more remarkable.
4. Whenever it met heights of a conical form it moved round them.
5. It crossed the river Le Vegre without following its course.
6. It developed heat to such a degree, that some persons experienced a sensation analogous to that of burning.
7. It displayed all the ordinary phenomena of a

terrestial waterspout, by exhibiting a mass of vapours similar to a dense cloud of a conical form, making a dreadful noise, throwing out flashes of lightning, spreading an odour like that of thunder, and scattering all round it a great quantity of water. See Dr. Brewster's *Journal of Science*, No. V. p. 181.

WATSON, Richard (Bishop of Llandaff), a learned chemist and able theological writer, was born in August 1737 at Heversham, near Kendal, where his father had been master of the free grammar school for 40 years. His ancestors had for many generations farmed the small property of Hardendale near Shap, where his father was born in 1672. He was educated at Heversham under his father's successor, and in 1754 he entered Trinity College as a sizer. In 1757 he obtained a scholarship for his mathematical acquirements, and in 1759, when he took his degree of B.A. he was classed a second wrangler. In October 1760, he was admitted Fellow of Trinity, and in November, assistant tutor to Mr. Backhouse. At the beginning of 1762 he took his degrees of M.A., and in the October following he was appointed moderator of Trinity College.

His friend and former pupil Mr. Luther, one of the members for Essex, having, in consequenc eof his separation from his wife, hastily quitted England, Mr. Watson, without any money, and without any knowledge of the French language, resolved to follow him for the purpose of soothing his agitated mind. He contrived, however, to surmount these obstacles, and in February 1764, after crossing the channel four times, and travelling 1200 miles in the course of a fortnight, he brought back his friend to his country and his family. In the same year he succeeded Dr Hadley, professor of chemistry at Cambridge, though he had never devoted his mind to the subject; but by the energy of his application, he was able, in the course of a year after his election, to deliver a very excellent and popular course of lectures on the subject, and to compose several learned chemical memoirs for the Philosophical Transactions, as well as a series of essays which were long used as one of the best popular introductions to the science. In October 1767, he succeeded Mr. Backhouse as head tutor of Trinity. In 1769 he was elected F.R.S., and on the death of Dr. Rutherford, he was appointed, in October 1771, to the lucrative office of Regius Professor of Divinity. In this new chair, he attracted a numerous audience, and his lectures were characterized by eloquence and independence of judgment. The scriptures he regarded as the only fountain of divine truth, and the opinion of fathers, churches, and councils, he considered as having no more authority than his own.

In December 1773 he married the eldest daughter of Edward Wilson, Esq. of Dallum Tower in Westmoreland, a connection which for more than 40 years was the source of uninterrupted satisfaction. Having obtained, through the interest of the Duke of Grafton, a sinecure in Wales, he exchanged it in 1774 for a prebend of Ely, and in January 1780 he became archdeacon of Ely; and in the same year Dr. Keene, Bishop of that see, presented him to the rectory of Northwold in Norfolk. In February 1781 he was presented by his pupil, the Duke of Rutland, to the rectory of Knaptoft in Leicestershire, and through the same influence Lord Shelburne conferred upon him the bishopric of Llandaff in 1782.

Lord Shelburne had expressed to the Duke of Grafton his expectation that Dr. Watson would write in favour of his administration, but the Duke informed him that he had entirely mistaken the character of the man, and that such expectations could never be realized. The preferment of our author of course stopped here. Though his principles were decidedly and openly avowed, yet he was too independent to be an instrument in the hands of any ministry, and though he did more than almost any individual to promote the true interests of the church of England, and to stem the torrent of infidelity and anarchy which at one time threatened to undermine both the altar and the throne, yet no British minister had the virtue to honour and reward such exalted services.

Conscious of the honesty of his zeal, and of the value of the services which he had done to his country, Bishop Watson retired in disgust from public life, and spent the rest of his life on his estate of Colgarth, which he had purchased, on the banks of the Windermere. There he devoted himself to agricultural pursuits, and in 1789 the Society of Arts gave him their medal for the extent of his plantations. His pupil, Mr. Luther of Ongar, who died in 1786, left him an estate which he sold for £20,000, and which placed him in wealthy circumstances.

Notwithstanding his devotion to rural pursuits, our author occasionally attended to his duties in the House of Lords, and he made some admirable speeches in that House on questions of engrossing interest, particularly on the abolition of the slave trade.

In 1813 he was seized with an illness of which he never recovered. He became gradually weaker and weaker, and expired on the 10th July 1816, in the 79th year of his age, leaving behind him two sons and several daughters. His eldest son entered the army, and his youngest son was prebendary of Llandaff and Wells.

The following is a list of the works of Bishop Watson.

1. Institutionum Chemicarum pars Metallurgica. 8 Comb. 1768.
2. Experiments and Observations on the Solution of Salts. Phil. Trans. 1770, p. 325.
3. Remarks on the Effects of Cold in February 1771. Phil. Trans. 1771, p. 213.
4. Experiment with a Thermometer having its bulb blackened. Phil. Trans. 1773, p. 40.
5. Chemical Experiments and Observations on Lead Ore. Phil. Trans. 1778, p. 863.
6. Observations on the Sulphur Wells at Harrowgate. Phil. Trans. 1786, p. 171.
7. Essay on the Subjects of Chemistry and their General Division.

8. Assize Sermon, preached at Cambridge, 1769.

9. Letters to the Members of the House of Commons by a Christian Whig, 1772.

10, 11. Two Sermons. 4. 1776.

12. A Brief State of the Principles of Church Authority, 1773.

13. A Fast Sermon, Feb. 1780.

14. A Sermon addressed to the Clergy of Ely, 1780.

15. Apology for Christianity, in a Series of Letters, addressed to Edward Gibbon. 12. 1776.

16. Chemical Essays, 5 v. 12. 1781-7.

17. A Letter addressed to Archbishop Cornwallis on the Church Revenues, 1782.

18. A Sermon preached the 30th January before the Lords. 4. 1784.

19. Visitation Articles for the Diocese of Llandaff.

20. Theological Tracts, 6 v. 8. 1785.

21. A Sermon on the Wisdom and Goodness of God, in having made Rich and Poor, 1785-1793.

22. Sermons and Tracts. 8. 1788.

23. An Address to Young Persons after Confirmation. 12. 1789.

24. Considerations on the Expediency of Revising the Liturgy. 8. 1790.

25. A Sermon preached for the Westminster Dispensary in 1785, with an Appendix.

26. A Charge to the Clergy of his Diocese. 4. 1792.

27. Two Sermons and a Charge. 4. 1795.

28. Apology for the Bible in a series of Letters addressed to Thomas Paine. 12. 1796.

29. An Address to the people of Great Britain. 8. 1798.

30. Charge to the Clergy of Llandaff. 31. Second Charge, 1802.

32. A Charge relating to Ecclesiastical Reform, 1802.

33. A Sermon preached at the London Hospital. 1802.

34. Thoughts on the Intended Invasion. 8.

35. Substance of a Speech intended to have been delivered, 1804.

36. Sermon preached before the Society for the Suppression of Vice, 1804.

37. A Charge to the Clergy, 1805. 38. Another Charge on the Catholic Question, 1808.

39. Two Apologies, two Sermons and a Charge. 8. 1806.

40. A Second Defence of Revealed Religion, 1807.

41. A Paper on Planting and on Waste Land, 1808.

42. Preliminary Observations on the Agricultural Report of Westmoreland.

43. Miscellaneous Tracts. 2. 8. 1815.

44. Anecdotes of his Life. 4. 1817, written by himself, revised in 1814. and published by his son Richard Watson, LL.B. Prebendary of Llandaff and Wells.

WATT, James, the celebrated improver of the steam-engine, was the eldest son of James Watt, a merchant in Greenock, and was born on the 19th January 1736. He received the rudiments of his education in his native town, and evinced an early partiality for mechanical pursuits. The bent of his mind led him to follow the profession of a mathematical instrument maker, and in his 18th year he went to London and remained a year under the tuition of a maker of mathematical instruments. The weak state of his health compelled him to return to Greenock, and after adding to his stock of practical acquirements by occasional visits to Glasgow, he resolved in 1757 to establish himself in that city. The corporation, however, considered this step as subversive of their privileges, and the professors of the college gave him apartments within its precincts, as mathematical instrument maker to the university. In this situation he became acquainted with Dr. Black, and with Mr. Robison, who was then a student at the university.

Mr. Watt continued in the college till the year 1763, when he took up his residence in the town, previous to his marriage with his cousin, Miss Miller, which took place in the summer of 1764.

The subject of the steam-engine had frequently been discussed between him and Mr. Robison, who had suggested the practicability of its being applied as the moving power of wheel carriages. So early as 1761 or 1762, Mr. Watt made some experiments on the force of steam with a Papin's digester, and he had even constructed a small model consisting of an inverted syringe, the bottom of the rod of which was loaded with a weight. This model he wrought with strong steam, which was alternately admitted below the piston and let off into the atmosphere. He soon abandoned this construction on account of its imperfections, and in the manner which we have already fully detailed in our History of the Steam-Engine, he was gradually conducted to those great improvements upon the steam-engine which have immortalized his name.

In the year 1767 Mr. Watt surveyed the Forth and Clyde canal, but as the bill was lost in parliament, he was enabled to superintend the execution of the Monkland canal, for which he had prepared the survey and estimates. Some time after he surveyed for the Board of Trustees, the projected canal from Perth to Forfar, and at the desire of the commissioners of the annexed estates, he made a survey of the Crinan canal, which was afterwards executed by Mr. Rennie. Mr. Watt's reputation was now widely extended; and he was employed in a great variety of public works which were then undertaken in Scotland; and he terminated his labours as an engineer with the survey of the Great Caledonian canal, since executed upon a more magnificent scale by Mr. Telford.*

Near the close of 1773, when Mr. Watt was engaged in this last survey, he had the misfortune to lose his wife, by whom he had a son and a daughter. A short time after this event he seems to have accepted the invitation of Mr. Boulton to settle in

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* Many of these labours of Mr. Watt as an engineer have been fully detailed in our article Navigation Inland, written by Mr. Telford.

England; and thus commenced that illustrious firm, the formation of which forms an epoch in the annals of the arts of England.

In the year 1775 Mr. Watt married his second wife, Miss Macgrigor, who still survives him, and from that period his time was occupied in those important arrangements regarding his patents, and in perfecting those inventions which we have already fully described.

While Mr. Watt was engaged in the survey of the Crinan, and Gilp, and Tarbet intended canals in 1772 and 1773, he employed two ingenious micrometors of his own invention for measuring distances, such as the breadth of arms of the sea, which could not be ascertained by the chain.

The following is Mr. Watt's own account and history of these inventions, as communicated by himself to Dr. Brewster in 1816.

The instrument I used was a telescope, with an object-glass of twelve inches, and an eye-glass of one and a-half inch focus, consequently magnifying eight times. In the focus of the eye-glass there were placed two horizontal hairs, and one perpendicular hair. The horizontal hairs were about one-tenth of an inch distant from each other, and as strictly parallel to each other, and at right angles to the perpendicular hair, as I could make them. A rod being placed upright at twenty chains distant, or any other convenient distance, on level ground, an index, consisting of a round disk of about eight inches diameter, painted white, with a horizontal line of one inch wide, painted on its horizontal diameter with vermilion, was fixed upon the rod about one foot from the ground, and another similar index was moved up and down the rod, until, upon looking through the telescope, the two horizontal hairs covered the red stripes on the lower and upper indexes; the telescope being turned on its axis until the perpendicular hair was parallel to the rod. The indexes being thus covered by the horizontal hairs accurately, the upper index was fixed to the rod, and the distance between the middle of the red stripes, on the two indexes, was divided from the red into twenty parts, representing so many chains, which, with the instrument I used, were upon the rod about four and a-half inches each; and for distances exceeding five chains, this division into equal parts was sufficiently accurate; but for short distances it is not strictly so. I therefore fixed a pin at every chain, and holding up the rod at each of them, made the necessary correction: and as the focus of the object-glass is also affected by the distance, it is proper to adjust the eye-glass to it at every station. The divisions on the rod being marked with the number of chains they represent, it was only necessary to send an assistant with the rod to any place the distance of which was wanted to be measured, and by signs to make him move the upper index up and down, until the two horizontal hairs covered the red stripes on the upper and lower indexes; the divisions on the rod then showed the distance, which I found could be ascertained to within less than one-hundredth part of the whole distance, and with a higher magnifying power, could be done proportionally more accurate. The rod I commonly used was twelve feet long, and consequently could measure thirty chains; but by sliding another rod upon it, so as to lengthen it, I measured greater distances; and where still greater were wanted, I stretched a tape horizontally, and turning the telescope on its axis, made the single hair parallel to it, fixing an index at the end of the tape, and sliding the other along it, until it subtended the distance between the rivers. I then measured the subtended tape with the rod, and so ascertained the distance; but this expedient I rarely had recourse to, the distance I generally had occasion to measure rarely exceeding half a mile, or forty chains.

It is plain that this instrument possesses the advantage of measuring all distances with equal accuracy, until the imperfection of vision at great distances interposes, as the scale on which they are measured expands with the distances, and in uneven ground it possesses more accuracy than the chain, and is very valuable in measuring distances from one hill to another, and across bays of the sea, where the chain cannot be used, which I experienced, in the survey of West Loch Tarbet, the northern shore of which is very much indented, and so rocky, that it is scarcely possible to measure a few chains in a straight line upon it.

I showed the instrument to all my friends at the time, and among others, Mr. Smeaton, as I have mentioned; and used it publicly in my surveys, and it was consequently known to many people, though not published.

A Mr. Green, in 1778, applied to the Society of Arts for a premium for the same invention, which Mr. Smeaton apprized me of, and also informed the society of my claims, in consequence of which I was desired to attend their committee, where I informed them of what I had done, and at what time. Yet the society thought fit to award Mr. Green the premium, though his invention was posterior to mine. I suppose because he had used an instrument of higher magnifying power, viz. forty, and consequently had been able to measure greater distances, and, as was said, with greater accuracy. I made no further reclamation, as I perceived it was not in that court that I could obtain justice; and as I dislike paper war, I did not apply to any other, though there were people then living who could have attested my use of it.

Another micrometer with a prism, I invented, I think, about that time; it consisted of a thin prism, with its surfaces nearly parallel, or inclined one degree or two. This prism was cut by a diamond into two parts, which, when they were fixed in the same plane, refracted all the rays which passed through them equally, but one of them remaining fixed, and the other moving on a centre, would refract that portion of the rays which passed through it, more than those which passed through the fixed part, and being placed in the focus of the object-glass of a telescope, two images were formed of each object, by which its diameter could be measured. An index, and divided sector of a circle, served to measure the comparative refractions.

This instrument I made with the sector and radius of wood, and gave it to Professor Anderson of Glasgow College; and, I suppose, it is still among his apparatus, which he left to a public institution.

The cross-haired micrometer, as described, leaving me too much in the power of my assistants, where the distances were greater than permitted me to read off the number of chains on the rod myself, I thought of another about 1772 or 1773, which consisted of a telescope with an object-glass of a long focus, say three or four feet; this was placed in a tube with a slit in one side of it, nearly as long as the focus of the telescope, and the object-glass being fitted to a short tube, which slid from end to end of the slit, could be moved backwards and forwards by means of a piece of metal fixed to the short tube, and coming out through the slit; a glass of six to nine inches focus was also fixed in the outer tube, of the nature of what is called a field-glass, and to this was added an eye-glass, with a cross hair piece in its focus.

Now, it is evident, that if the object-glass be moved nearer the field-glass, their common focus will be shortened, and the image at the cross hairs diminished proportionally, until the glasses come into contact, when their common focus will be shorter than that of the field-glass alone; and two indexes fixed upon a rod being subtended by the cross hair. At any given distance, the same rod with its indexes being removed nearer the observer, upon sliding the object-glass nearer the eye, they may again be subtended by the cross hairs, and a scale on the side of the tube will show the comparative distance they have been removed, and the distance of the first object being known, that of the second will also be so. This scale could not, however, be a scale of equal parts, but one which could easily be laid down.

I made a rough model of this instrument at the time, but have never completed it, having been since engaged in concerns where such instruments were unnecessary. I described it, however, to several of my friends at the time, and among others, to the late Mr. Ramsden; but whether it has been thought of by any one else, or the problem published, I am ignorant.*

Another of Mr. Watt's minor inventions is his perspective machine, which he contrived in 1765, in consequence of his friend Dr. James Lind having brought from India a machine invented there by a Mr. Hurst. As this machine had many defects, Mr. Watt wished to make one more portable and easier in its use, and, at the suggestion of the late Dr. Robison, he turned his thoughts to the double parallel ruler, an instrument then very little known, and scarcely if at all used. After some reflection, Mr. Watt contrived a method of applying it for this purpose, and of making the machine extremely light and portable. A description with drawings of the machine, which Mr. Watt communicated to Dr. Brewster, was published by the latter in the *Edinburgh Philosophical Journal*.† About from fifty to eighty of these instruments were made at the time, and went to various parts of the world. Mr. George Adams, senior, copied some of those that went to London, and made them for sale.

In the year 1780, Mr. Watt took out a patent for a method of copying letters and drawings, and the apparatus was manufactured in a partnership with Mr. Boulton and Mr. Keir, under the firm of James Watt and Company. This method consists in writing the letter to be copied with an ink partly soluble in water. It is then pressed against a sheet of thin unsized and wetted paper, and the impression then taken is read on the other side of the paper from that on which the impression is taken. The apparatus was constructed in two forms, one was a strong rolling press, with large rollers proper for an office, and of a sufficient size to copy plans and drawings, and the other was a compact rolling press and apparatus for copying letters, enclosed in a portable writing desk, which folds up into a moderate compass for travelling. When the original is written in strong characters with a sufficiency of ink, three or four successive copies may be taken off upon as many thin sheets of paper, and they will be very legible; but when a single copy only is taken, the writing upon it appears very black, and the original is not at all injured by the operation.

In the year 1781 Mr. Watt contrived a steam-drying apparatus for his relation Mr. Macgrigor of Clober near Glasgow, of which we have already given a drawing and description in the article STEAM DRYING.

In the *Philosophical Transactions* for 1745, Colonel Cook had proposed a method *for warming rooms by the steam of boiling water conveyed in pipes along the walls.* This method does not seem to have been practically adopted till 1784-5, when Mr. Watt, who probably did not know of Colonel Cook's proposal, put up an apparatus for heating his study by means of steam. This method has since been extensively applied to heat private houses and manufactories, and has been more recently adopted for conservatories and hot-houses.

The discoveries of Dr. Priestley in pneumatic chemistry had excited very general interest, and Mr. Watt, who had taken a particular interest in the discoveries of his friend and neighbour, seems to have devoted considerable attention to the subject. The following account of his labours is given by one of his biographers. See *Supp. Encyc. Brit.*

"Early in 1783 he was led, by the experiments of his friend and neighbour, Dr. Priestley, to the important conclusion that water is a compound of dephlogisticated and inflammable airs (as they were then called), deprived of their latent or elementary heat, and he was the first to make known this theory.

"This was done in a letter to Dr. Priestley, dated the 28th April 1783, in which he states the Doctor's experiments to have come in aid of some prior notions of his own, and supports his conclusions by original experiments. That letter Dr. Priestley received in London, and after showing it to several members of the Royal Society, he delivered it to Sir Joseph Banks, with a request that it might be read at some of the public meetings of the Society; but before that could be complied with, Mr. Watt, having heard of some new experiments made by Dr. Priestley, begged that the reading might be delayed. These new experiments soon afterwards proved to have been delusive, and Mr. Watt sent a revised edition of his letter to Mr. de Luc on the 26th November of the same year, which was not read to the Society until the 29th April 1784, and appears in the *Phil. Trans.* for that year, under the title of *Thoughts on the constituent parts of Water, and of Dephlogisticated Air, with an account of some experiments upon that subject.*

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* See our article MICROMETER.

† Dr. Brewster is in possession of one of these instruments, presented to him by Mr. Watt, and executed with his own hand

"In the interim, on the 15th January 1784, a paper by Mr. Cavendish had been read, containing his *Experiments on the Combustion of Dephlogisticated and Inflammable Airs*, and drawing the same inference as Mr. Watt, with this difference only, that he did not admit elementary heat into his explanation. He refers in it to his knowledge of Mr. Watt's paper, and states his own experiments to have been made in 1781, and mentions Dr. Priestley; but he does not say at what period he formed his conclusions: he only mentions that a friend of his had given some account of his experiments in the summer of 1783 to Mr. Lavoisier, as well as of the conclusions drawn from them. It is quite certain that Mr. Watt had never heard of them, and Dr. Blagden has stated that he mentioned at Paris the opinions of both the English philosophers, which were not admitted without hesitation, nor until the French chemists had satisfied themselves by experiments of their own."*

We have copied the preceding statement as that of Mr. Watt's friend; but a regard for the reputation of Mr. Cavendish, independent of higher motives, compels us to acknowledge that the statement is partial, and the argument not well founded. We are not able at present to refer to the original documents, but we had occasion some years ago, along with a distinguished chemist, to examine them with minute attention, and it was then our decided conviction, that the merit of the discovery of the composition of water belonged to Mr. Cavendish.

Mr. Watt had the satisfaction of introducing into Great Britain, the new art of bleaching by the oxymuriatic acid, which had been discovered by M. Berthollet; but as the history of his labours has been already given in our article BLEACHING, Vol. III. p. 554, Note, it is unnecessary to resume the subject at present.

In the year 1809, the Glasgow Water Company proposed to derive their supply from a well and tunnel formed in a stratum of sand on the left bank of the Clyde, which affords a natural filter for the water of the river. As the city lies on the right bank, it was necessary to convey the filtered water across the river, which was a problem of considerable difficulty. Mr. Watt, who was consulted on the occasion, suggested that a flexible water main should be drawn across the bed of the river, through which pumping engines on the north side should receive the water from the well on the south side. The work was completed in 1810, and a second main was afterwards laid in every respect similar to the first. The idea of the flexible or ball and socket joints, was suggested to him, as he himself informed the editor of this work, from a consideration of the flexibility of the lobster's tail.

In the latter part of Mr. Watt's life, his attention was directed to the construction of a machine for copying and reducing all kinds of sculpture and statuary. Having so often experienced the evils of communicating his ideas to others, he had kept secret the details of his plan, and even his intention of executing such a machine. When he had made considerable progress in its execution, and had thought of securing it by patent, he learned that a person in his neighbourhood was occupied with the same object, and we have heard Mr. Watt say that he believed that this gentleman was entirely ignorant of his labours. A proposal was then made to prosecute the subject jointly, and to secure the privilege by a joint patent, but Mr. Watt saw many objections to such a plan, and was unwilling at his advanced period of life to embark in new projects which required for the prosecution all the ardour of youth. We have seen at Heathfield some of the works executed by this machine, and these prove beyond a doubt the entire practicability of the plan.

Mr. Watt had withdrawn from business in the year 1800, when he resigned his shares to his sons, the present Mr. James Watt, and Mr. Gregory Watt, who was prematurely carried off in the prime of his life, when he had began to exhibit proofs of talents, which might have rivalled those of his father.

In the year 1813, when Dr. Brewster was engaged in editing the works of the late Dr. Robison, he had the good fortune to prevail upon Mr Watt to undertake the revision of the treatise on the steam-engine, but though he intended only to correct imperfections and supply defects, yet he was gradually led to extend his views, and to compose those valuable additions on the history, the principles, and the construction of the steam-engine, which are published in the 2d volume of Dr. Robison's System of Mechanical Philosophy. In a preliminary letter addressed to Dr. Brewster, and dated May 1814, Mr. Watt has corrected many misapprehensions which had universally prevailed respecting the early history of his labours.

During the greater part of his life, Mr Watt had been in an infirm state of health. His constitutional debility was greatly increased by the cares and anxieties which necessarily attended the labours of his mind and the litigations in which he was involved. Sick headaches, of great severity, and arising from an organic defect in his digestive powers, had often embittered his existence; but by good management and great abstemiousness, they diminished as he advanced in life, and, without any diminution of his mental powers, he reached the 84th year of his age, when after a short illness he expired without suffering, in the midst of his family, at Heathfield, on the 25th August 1819.

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* "There is a confusion of dates in the account of this affair.—Mr. Watt's letter to Mr. de Luc, in the *Philosophical Transactions*, appears dated 26th November 1784, which is evidently an error of the press. Mr. Cavendish, in his letter, read 15th January 1784, speaks of Mr. Watt's paper "as lately read before the Society," whereas the paper itself purports to have been read on the 29th April 1784. This we cannot explain."

His mortal remains were interred in the chancel of the parish church of Handsworth, near those of his friend Mr. Boulton. An excellent bust of Mr. Watt was executed by Mr. Chantrey some years before his death, and a full length statue has been completed by the same artist, at the desire of his son the present Mr Watt, to be placed upon his tomb.

Mr Watt was elected a Fellow of the Royal Society of Edinburgh in 1784. He was admitted into the Royal Society of London in 1785, and in 1787 he became a corresponding member of the Batavian Society. The university of Glasgow created him Doctor of Laws in 1806, and in 1808 he was elected a corresponding member, and afterwards an associate of the Institute of France.

The character of Mr Watt as a mechanician and engineer, does not require to be drawn. It is impressed upon the great inventions which he has bequeathed to his country and to mankind. His knowledge, however, was not confined to those subjects which were connected with his professional pursuits. He was profoundly versed in chemistry and various branches of physical science. He was well acquainted, too, with modern languages and literature, and he was deeply read in metaphysics, medicine, etymology and law. These rare acquirements he owed to a powerful memory, which enabled him to retain every thing useful that he had read, but which also rejected any thing that was trivial or insignificant. In his personal character, Mr Watt exhibited the most amiable qualities. In the various relations of a husband, a father, and a friend, the kindness of his nature was strikingly displayed. In society he was modest and reserved, though always ready to take his share in the conversation, whether it was trivial or profound. A short time after his death, the character of Mr. Watt was drawn with much eloquence and feeling, by his friend Mr. Jeffrey, and published in the papers and journals of the day. No extended account of Mr. Watt's life has yet appeared; but we have been long expecting a complete memoir of his life, writings and inventions, from the pen of his son.

WATTS, Isaac, an eminent divine and poet, was born at Southampton in 1674. He entered the ministry in 1702, but his feeble state of health disqualified him from his public duties in 1712. In this state he was invited to the hospitable mansion of Sir Thomas Abney, where he resided during the rest of his life. The universities of Edinburgh and Aberdeen conferred upon him the degree of D.D. in 1728. He died at Stoke Newington, on the 25th November 1748, in the 75th year of his age.

Among his works may be enumerated his Logic, his Discourse on Education, his Philosophical Essays, his brief scheme of Ontology, which along with his sermons, and his poetical writings, viz. Horæ Lyricæ, and his psalms and hymns, &c. were collected and published by Dr. Gibbons in 6 vols. 4to. in 1754. See Gibbons's *Memoirs of Watts*, and Johnson's *Lives of the Poets*.

WAVES. See Hydrodynamics.

WAVELLITE. See Mineralogy, *Index*.

WAX. See Chemistry, *Index*, and France, *Index*.

WAYNE, Anthony, eminent during the war of the American Revolution for his abilities and services as a soldier and a general, and through life as a patriot, was born in the township of Eastown, Chester County, Pennsylvania, on the first day of January 1745. His ancestors were natives, originally, of Yorkshire, England; his grandfather removed to Ireland, and located himself in the county of Wicklow; they appear, all of them, to have been celebrated for their martial propensities; for not only was the gentleman of whom we speak in command of a squadron of dragoons in the army of King William at the battle of the Boyne—but his son, the father of the subject of the present brief notice, as a commissioned officer in America, repeatedly distinguished himself in expeditions against the Indians.

Mr Wayne's grandfather removed from Ireland to Pennsylvania, a country more congenial to the warmth of his republican principles, in the year 1722, and purchased a large real estate in the county of Chester. His son Isaac, the father of the general, besides the military duties we alluded to above, and which he performed very greatly to his credit, most honourably represented the county in which his father had fixed his abode, in the provincial legislature. He died in the year 1774, leaving but one son, Anthony, and two daughters.

The future hero of Stony Point was destined by his father to the profession of an agriculturist—but the tardy labours of the field were soon found but poorly to accord with the ardent temperament and more ambitious views of young Anthony. He was, accordingly, committed by his father to the care and tuition of his uncle Gabriel Wayne, who is said to have been a man of very considerable talents and erudition.

His first essay in learning appears to have been productive of so little fruit, that his uncle sent him home to his father, under the full persuasion that parental affection had blinded him completely in his estimate of his son's abilities. He told him in a letter, which is worthy of preservation, "that his son would never make a scholar; he might, perhaps, make a soldier; he has already distracted the brains of two-thirds of the boys under my charge, by rehearsals of battles, sieges, &c. They exhibit more the appearance of Indians and Harlequins than students. This one decorated with a cap of many colours; others habited in coats as variegated, like Joseph's of old; some laid up with broken heads and black eyes. During noon, in place of the usual games of amusement, he has the boys employed in throwing up redoubts, skirmishing,

&c." The effect of his father's severe remonstrance and threat to make him return to the painful drudgery of the farm, was to call forth the latent energies of young Wayne's character; he returned to school, and devoted himself with such ardour to his studies, that in the course of eighteen months this very uncle was forced, and gratified too, to admit, that his young charge had exhausted all his stock of information in the mathematics, and he therefore advised his brother to send Anthony to Philadelphia, for the purpose of completing his education at an academy.

At 16, then, he entered the Philadelphia Academy, and remained at that institution until he was 18 years of age. His attachment to the mathematics, probably arising from their connection with the science always uppermost in his mind—that of war—induced him to devote almost his entire attention to that branch of learning; of the dead languages he acquired merely the rudiments. Upon his return to his native country, as a surveyor of competent abilities was much needed at that period in the settlement of controversies arising from ill-defined and disputed lines, and from the location of roads, he commenced the business of surveying, connecting with it the pursuit of practical astronomy and engineering. He has left several manuscripts on those subjects, which have reflected great credit on his learning and capacity.

Doctor Franklin, whose mind was always active, suggested the purchase and settlement of a large body of land in the province of Nova Scotia. A company was soon formed, of which many wealthy and influential persons became members. And Mr. Wayne, who was then in his twenty-first year, and whose talents were, even at that early age, known and appreciated, was appointed the agent to carry into effect the objects of the association. In the month of March 1765, Wayne embarked for Nova Scotia, and entered on the discharge of very responsible and arduous duties. These he performed to the perfect satisfaction of his employers, and returned to Pennsylvania in the middle of the following December. His agency required the performance of several additional journeys to that country, before the complicated affairs which were entrusted to his good management were put upon a sure and satisfactory footing.

In the year 1767, Mr. Wayne having married the daughter of Bartholomew Penrose, an eminent merchant of the city of Philadelphia, established himself on a farm in his native county. From this period till 1774 his time was devoted to agriculture and practical surveying; but he was soon called to the discharge of infinitely higher and more noble offices. The revolution, which elicited into active exercise the independent feelings of a whole nation, and has inscribed on the rolls of fame a host of names, that might otherwise have passed down the stream of time into the ocean of oblivion, unknown and unhonoured, was about to commence. Mr. Wayne entered at once into the feelings which animated every honourable and virtuous bosom, and, sacrificing the enjoyments of domestic felicity, devoted his future efforts to the support of his country's independence.

He was one of the provincial deputies, who, early in the year 1774, were selected to take into their consideration and make report of the alarming differences between Great Britain and her colonies. Wayne was chosen, also, a member of the Pennsylvania convention, which assembled at Philadelphia, and by its spirited conduct did so much to invigorate the rising spirit of resistance throughout the land.

Many of the members of that convention were second to none in the country in the two great qualities which the times emphatically demanded soundness of head and stoutness of heart; and Wayne was not behind any of his compatriots in either of these qualifications. Following the bent of his natural disposition, he determined to put in operation as soon as the moment came, the military abilities which he had received from nature and had improved by art.

Previously, however, to taking the field, in the summer of 1775, Mr. Wayne was appointed a member of the committee of safety, along with Dr. Franklin and other distinguished men. This committee was entrusted with the duty of calling into actual service "The Associators," and generally of providing for the defence of the province.

As he perceived war to be inevitable, he determined that so far as his exertions could compass the point, the country should not be unprepared. He assembled numerous bodies of the yeomanry, whom his popularity readily attracted to his standard, for the purpose of perfecting their discipline, and appointed frequent drills for that object. To devote himself more entirely to this end, he withdrew from the civil councils of his native state in the month of September 1775; and in a very short time organized a regiment of volunteers, who unanimously elected him their colonel; the discipline of this corps was a matter of surprise even to those who had the highest ideas of his military capacity.

On the 3d of January 1776, Congress appointed him a colonel of one of the regiments which they had resolved to raise for the state of Pennsylvania; and to the great satisfaction of Colonel Wayne, his former volunteer associates, almost unanimously, agreed to transfer themselves to the regular service of their country; so that, without much loss of time, he was enabled to take the field under his commission. In the commencement of the campaign of that year, he was ordered to join the army under General Lee at New York, and shortly after marched with his regiment to Canada. In the unfortunate attack made under the direction of General Thompson, upon the advanced guard of the British, who were posted at Three Rivers, and commanded by General Frazier, Colonel Wayne exhibited distinguished bravery, and, though wounded, by his good conduct contributed most materially to unite and bring off the dispersed and broken troops. The commanding officer had been taken prisoner during the engagement.

It is known, that after this defeat, the American army was compelled to retreat from Canada, and concentrated itself at Ticonderoga, a fortress on Lake Champlain. At this post and its dependencies, the revolutionary troops determined to make a stand, and maintain it at every sacrifice. The British commander, Carlton, with his fleet and army, reconnoitred the position, and feeling no inclination to disturb troops who were apparently resolved to make the most vigorous defence, thought it best to retire into winter-quarters.

By the departure of General Gates, the command of the army in that quarter devolved upon General Schuyler, who paid the very flattering compliment to Colonel Wayne of entrusting to him the care of the important fortresses of Ticonderoga and Mount Independence. This trust, from the month of November 1776 to May 1777, was executed by the commanding officer in a way to merit the approbation of his general, and to reflect additional honour upon himself.

On the 21st day of February 1777, he was promoted by congress to the rank of brigadier-general; and upon leaving the above named fortresses, joined the main army under the command of General Washington, in New Jersey; with his gallant Pennsylvanians, he contributed, by the testimony of Washington himself, "a large share of bravery and good conduct" in driving the enemy out of that state.

As soon as Sir William Howe developed his object of attempting the conquest of Pennsylvania, and particularly of the capital, Philadelphia, General Wayne was directed by the commander-in-chief to proceed to his native county, in order to discipline and arrange the militia who were to rendezvous there. This duty he satisfactorily and promptly performed, and then formed a junction with the main army, which was posted at Brandywine, under the command of Washington, in order to prevent, if possible, the advance of the British upon the capital. The design was a brave, though a hopeless one; 15,000 men, many of them the raw militia of the country, were but poor antagonists for 18,000 regulars, completely appointed and equipped. And though the result was in favour of superior force and discipline, the merit of the attempt was none the less. Wayne and his division earned some of the brightest laurels that were gathered on that day, by his spirited resistance to the passage of Chad's ford by the column under Knyphausen. Their steady resistance to the Hessians prevented material annoyance to the retreating columns of the Americans.

On the road to the city, the undaunted Washington again stopped, with the intention of trying once more the fortune of war. The battle was already commenced by Wayne and his troops, when a terrible tempest scattered and separated the combatants. The commander, always on the alert, directed General Wayne to make the daring attempt of cutting off the enemy's baggage—the best dispositions were made by him for the purpose, and most probably, but for the disclosures of some traitors, the enterprising scheme would have met with complete success. As it was, however, the wretches we have alluded to piloted the British troops over hills and along by-paths, and by this means they succeeded in surprising the small but gallant band of Americans. The ruthless massacre, at the Paoli tavern, as this combat has been designated, was not soon forgotten. The merciless regulars spared not even the sick and perfectly helpless opponents, but put to death all within their power. They, however, met with the most severe reception, numbers of the assailants being killed in the attempt.

This was the only occurrence in General Wayne's long and distinguished career, which met with censure and disapprobation. Conscious that the misfortune was not owing to his want of bravery or skill, he demanded a court-martial, by whom he was acquitted with the highest honour.

In the bold attack made by General Washington upon Howe's army encamped at Germantown, Wayne took, as he always did, a prominent part. He mingled in the thickest of the fight—his horse was killed under him, and himself wounded. In fact, during the whole of the eventful campaign of 1777, the subject of this memoir passed through all the vicissitudes of the military operations of the year, under the immediate command of Washington. In councils, public and private, he rendered his commander the most effectual assistance. It should be mentioned, too, that, at that period, owing to a variety of circumstances, Wayne performed all the duties which are usually allotted to three general officers.

His health had suffered so severely from his continued and laborious exertions, that some respite was necessary. He accordingly occupied his leisure time in proceeding to Lancaster, then the seat of government of Pennsylvania, for the purpose of procuring comfortable clothing for the perishing troops. By his exertions, the Pennsylvania line made in this particular a tolerably respectable appearance. Upon his return to the army he found them labouring under an almost total want of provisions; and he was despatched by General Washington upon the most arduous and hazardous enterprise, during the most inclement season of the year, of securing the cattle on the eastern banks of the Delaware, and of procuring forage for the cavalry horses. He returned to camp, to receive the thanks of his commander and the blessings of the troops (after a long series of skirmishes, in which he invariaby chastised the enemy), with several hundred head of fine cattle, many excellent horses suitable for cavalry service, and with an abundance of forage. After the evacuation of Philadelphia by the British, and the transfer of the command of their army from Howe to Sir Henry Clinton, the enemy retreated through Jersey, followed by the Americans. Washington, being about equal in numbers, was anxious to attack the British army, and called a council of war for the purpose of taking their advice. But one other general, besides Wayne, concurred in the views of the commander; and he, being anxious to close with his new antagonist, resolved to take his measures on his own responsibility. It is known, that the good results to have been expected from this well-directed and spirited attempt were very considerably affected by the yet unexplained conduct of General Lee, in ordering the retreat of the advanced corps, of which he had the command;

victory, however, settled on that occasion on the American banners; and very much of the praise, so hardly earned by the fight at Monmouth, is due to the gallant manner in which Wayne seconded the views of the ardent Washington.

In consequence of some severe strictures made by General Lee upon the testimony made by Wayne upon that officer's trial, a correspondence passed between them, which reflected much credit upon both. It is the only instance (and it is a proof not only of Wayne's amiable disposition, but of the respect entertained for him by all), in the space of his military career, in which conduct was manifested towards him, by any, that he felt bound to regard as an insult, or to resent as such.

Principally by the exertions of General Wayne, the Pennsylvania line were, after the campaign, comfortably quartered in their huts; and he then surrendered his command to General St. Clair, being called by business to the assembling of the Legislature of his native state. Being anxious to return to active business, he requested from General Washington a situation in the light corps, if the arrangement could be made without injury to the service; and Washington, as soon as such a corps was organized, availed himself with alacrity of the tender of General Wayne's services.

The campaign of 1779 opened under gloomy auspices. The winter had passed without the proper preparations on the part of government for a continuance of the war. The British commenced their destructive predatory excursions in the southern and eastern states. It, however, was destined not to close without conferring on General Wayne the brightest wreath of glory he had ever won. The British commander, Clinton, in pursuance of an enlarged plan of operations, moved up the Hudson with a considerable force, and made himself master, among other fortresses, of the important position called "Stony Point." It was highly important to the American cause that this strong fortress should be recaptured, and the execution of the important design was entrusted to the bravery and skill of Wayne. Most nobly were the wishes of all his friends fulfilled.

The situation of that post is probably familiar to all. It is a high, rocky position on the left bank of the Hudson, below West Point, of a steep and rugged ascent; and garrisoned, as it was, by 600 chosen men of the British army, under the command of a distinguished officer, it was deemed by their leader almost impregnable. Several breastworks and strong batteries were advanced in front of the principal work, and two rows of abbatis were placed about midway up the ascent. Several vessels of war were also stationed in the river, and commanded, in some measure, the ground at the foot of the hill.

Having disciplined his gallant little corps, and equipped them in the handsomest possible manner, between twelve and one o'clock of the morning of the 16th July 1779, Wayne advanced to the assault. Our limits will not permit a detailed account of this glorious achievement. Wayne was wounded in the head with a musket-ball in ascending the hill; he instantly fell, but as quickly rose on one knee, and immediately exclaimed—"forward, my brave fellows, forward;" then, in a suppressed voice, addressing his aids, "assist me—if mortally wounded I will die in the fort," and supported by them (Major Fishbourne and Mr. Archer) he entered the works among the foremost of the gallant troops. The whole garrison, cannon and stores were captured, with very inconsiderable loss on the part of the assailants. The congratulations he received from all sides, and the honours conferred by congress and the legislature of his native state, it would be impossible to detail. It is, however, a pleasure to insert the testimony of a most capable judge, and the more gratifying, as an unfortunate misunderstanding, which has been before alluded to, had occurred between the parties. General Charles Lee wrote thus to him:—"I do most sincerely declare, that your action in the assault of Stony Point, is not only the most brilliant, in my opinion, through the whole course of the war, on either side, but that it is one of the most brilliant I am acquainted with in history; the assault of Schweidnitz, by Marshal Laudun, I think inferior to it."

The conduct of General Wayne, throughout the trying scenes that arose from the famous mutiny of the Pennsylvania line, was marked by gallantry on the one hand, and on the other by a proper regard to the sufferings of the troops. That mutiny, it is known, arose from the extreme sufferings and privations which the soldiers underwent, from the total absence of common necessaries. Wayne was very instrumental in bringing about a comparatively peaceable adjustment of a revolt which threatened at one time the most serious consequences to the peace of the country.

The theatre of the war being now (1781) transferred to the southern states, where the traitor Arnold was committing numerous ravages, and where Lord Cornwallis had assumed the command of the British army, the Marquis Lafayette was detached with a strong body to the reinforcement of the southern army, and General Wayne was ordered to join him with as many Pennsylvanians as he could organize. He effected a junction with the marquis in spite of Cornwallis's strenuous exertions to the contrary, and by their judicious movements, the two generals prevented the destruction of the public magazines which had escaped the grasp of Arnold, and which Cornwallis was anxious to lay waste. The two armies maneuvered for some time in face of each other; that under Cornwallis showing no particular anxiety for battle; till at length, at Green Spring, General Wayne, who commanded the advanced-guard, and who was pushing forward to carry into effect the marquis's plan of cutting off Cornwallis's rear-guard, found himself suddenly opposed by the whole British army. With his usual gallantry, instead of retreating, he advanced rapidly, and made a bold charge on the English line; a warm action ensued, and by the arrival of Lafayette, the detachment of Wayne was supported. The instant that a check had been given to their opponents, Wayne fell back upon the main body, and the British general, supposing their force to be greater than it was, admitted of no pursuit. General Wayne received compliments from all quarters, on account of his spirited conduct in this affair.

The British commander, Cornwallis, now took up his position at Yorktown, so famous in the history of the American war; and Washington immediately began his measures to lead Clinton into the supposition that he was to be the object of attack, and finally to bear down upon and, if possible, capture the devoted Cornwallis. In this plan General Wayne was directed to co-operate. He was to watch the British leader and prevent his retreat into North Carolina.

The details of the maneuvres of the besieging army at Yorktown, and the glorious results, are too well known to require repetition; suffice it to say, that the subject of this notice earned his full share of the glory of the contest. To have borne a part in the events of that ever memorable capture would seem all-sufficient praise. No repose was accorded to the brave Wayne. He was immediately directed to join the army under General Greene, to whom his presence was highly acceptable. The capture of Cornwallis enabled him to render that assistance to the state of Georgia, of which, at that time, she stood so much in need. Besides the incursions of the enemy, who had ravaged the country almost without opposition, the friends of liberty in that state suffered severely from the deadly hatred entertained towards them by the tories. To compose these differences, and to free the country from the enemy, General Wayne was sent by Greene. On his arrival, he found that, besides his other duties, it was necessary to compose the differences which had broken out among the officers, and to procure almost every apparatus of war without money. He had but little acquaintance with the climate and country, and was but slightly known to the officers. The difficulties, then, in his path, were not easily surmountable; by his zeal, enterprize and perseverance, however, he found means to overcome them all.

Near the Ogechee river, he had the opportunity he was anxiously looking for, of meeting the enemy in force; and the result of his attack was their precipitate flight and rout. Shortly after, a strong body of the Creeks, the Indian allies of the British, made an attack upon the rear-guard, which was then commanded by Wayne in person, and were completely repulsed. This formidable auxiliary force was by this defeat prevented from joining the enemy. Wayne's horse was killed in this conflict, and he had to fight sword in hand with his savage assailants. He says himself, in a letter to General Greene, that so determined was the bravery of the Indians, that after he had cut down one of their chiefs, with his latest breath he drew the trigger of his musket, and shot his noble horse dead under him.

The British shortly afterwards evacuated Savannah, and that city was immediately taken possession of by General Wayne. Previously to the retreat of the enemy, a correspondence was held with him on the subject of the surrender, and he most readily agreed to protect the persons and property of those who chose to remain. He was immediately recalled to co-operate with General Greene in South Carolina, at a time when he was forming the most enterprising schemes for the annexation of Florida to the United States.

After the two generals had formed a junction they commenced at once a series of operations for the purpose of expelling the enemy from Charleston, but were relieved from the necessity of much active exertion by the offer of General Leslie to abandon the place. This was accordingly done, and on the morning of the 14th of December 1782, General Wayne had the satisfaction of taking peaceable possession of Charleston. This was his last active and military movement in the revolutionary war, which he had contributed so much by his bravery and good conduct to bring to a successful and glorious issue.

After some necessary arrangements, in the month of July, General Wayne embarked for Philadelphia; he had been previously suffering severely from an attack of fever, and upon his return he had a relapse. After an illness, which nearly brought him to his grave, he recovered; but he had missed the opportunity of being present at the interesting spectacle which took place in New York, subsequently to its evacuation by the British. The great and the good Washington bade then an affectionate adieu to his comrades in arms, and Wayne deeply regretted his absence from a scene so touching. He so expressed himself in a letter to the general, who gave him a cordial invitation to pay him a visit at Mount Vernon. On the 10th October 1783, for his many and distinguished services, Wayne was brevetted a major-general, in accordance with a resolution of congress. Under the old constitution of Pennsylvania, which was ratified on the 28th day of September 1776, there was a provision, that on the second Tuesday of October 1783, and in every seventh year thereafter, there should be chosen by ballot, two persons in each city and county of the state, who were to constitute the council of censors; and it was their duty to inquire whether the constitution had been preserved inviolate in every part, and whether the legislative and executive branches of government had performed their duty as guardians of the people, or had assumed greater powers than were entrusted to them by the charter. They had also power to inquire whether the public taxes had been justly laid and collected; to order impeachments, pass public censures, recommend to the legislature the repeal of such laws as they judged to be contrary to the constitution, and generally to see that the laws had been duly executed. The year in which the council of censors was to have its first existence, was also the first year of peace; a remarkable coincidence, which could certainly not have been anticipated when the constitution was created. To this exalted and very responsible situation, the most honorable that then presented itself, General Wayne was appointed by his fellow-citizens; and it appears that he *took* a very active part in the proceedings of that body. Much good was anticipated from the controlling and supervisory powers of the council; but as it had a very brief existence, its good or its bad effects are mere matters of speculation, in which no experience is at hand to assist in forming a correct judgment.

The term of a censor was limited in duration to one year; at the expiration of that period he was returned to the assembly, as a member for the county of Chester. In this body he served two years, and was one of the most zealous of the representatives in his exertions for the good of his native state. The early abrogation of the Pennsylvania test laws was principally due to the earnest and repeated exertions of the general. Another subject, too, which he brought to the notice of the general assembly, is an evidence of the acuteness of his mind, and of the clearness with which he saw the true interests of his country. He proposed a resolution, on the 7th of November 1785, to appoint a committee to revise the laws relative to the navigation of the river Susquehanna and other streams, and also to report a bill for the improvement of the navigation between the waters of the Delaware and the Chesapeake, by means of a canal. The committee made a report, approving of the plan; and the executive council was authorized to enter into a negotiation with the states of Maryland and Delaware, in order to effect the object. This was the first movement that had been made in Pennsylvania, on the interesting subject of inland navigation, since the revolution. The proposed canal is now in full operation; and the state is deriving all the benefit from it which the sagacity of General Wayne so clearly foresaw would flow from its completion.

The pressure of domestic concerns deprived the state of the benefit of a continuance of the general's services. He was induced, from a necessary regard to them, to resign his seat in the legislature. About the same time, the most pressing solicitations were made to him to induce him to become a candidate for the presidential chair of Pennsylvania; the same imperative necessity, however, compelled him to decline the proffered honour.

In the year 1782, the state of Georgia, with a view to induce him to become a member of that state, and to reward him for his important services, complimented General Wayne with the grant of a large and valuable landed estate. He, therefore, was the owner of considerable real property in both states, and passed his time pretty much between the two. His residence became a matter of doubt, and finally of judicial decision in a particular case. In the year 1787, his fellow-citizens of Pennsylvania elected him a member of the convention which afterwards adopted the constitution of the United States; and in the year 1791, his fellow-citizens of Georgia, determined not to be outdone, chose him a member of the United States Congress. This last election gave rise to very considerable and animated discussion. It was finally canvassed and set aside; immediately afterwards, President Washington appointed Wayne to, probably at that moment, the most honourable, and at the same time the most responsible, situation within his gift. We allude to the appointment of commander-in-chief of the United States armies. The circumstances which made the nomination so highly important, will be presently briefly mentioned.

In accepting the appointment, General Wayne, in a letter to General Knox, then secretary of war, with his usual modesty, remarked: "I clearly foresee, that this is a command which must inevitably be attended with the most anxious care, as well as great fatigue and difficulty, and one from which more may be expected than will be in my power to perform; yet I should be wanting both in point of duty and gratitude to the president, were I to decline an appointment, however arduous, to which he thought proper to nominate me. I therefore accept of the trust that he has been pleased to repose in me, in full confidence of the most effectual support from the president and yourself; and I shall attend at such time and place as you may direct, in order to file the oath of office as prescribed by law."

The object of General Wayne's appointment was, if possible, to bring to a favourable close the long-protracted and disastrous war with the Indian tribes which had raged on the north-western frontier. The magnitude of the trust will appear very clearly from a slight review of the then state of affairs.

After the peace with Great Britain was concluded, many of their Indian auxiliaries, incited, it was believed, by the English themselves, refused to lay down their arms and to enter into a treaty. They committed horrible depredations upon the settlements bordering on the Ohio. From the year 1783 to 1790, it was supposed that, upon those waters, fifteen hundred men, women and children had been slain or made captive by the savages. Every species of barbarity had been exhibited towards the frontier settlers. More than two thousand horses had been stolen from the inhabitants. Negotiations were attempted with the Indians; but they rejected them with disdain. The government then despatched Brigadier General Harmer into their country in order to bring them to reasonable terms, and put a stop to their devastations. That brave officer, in the summer of 1790, was defeated by the Indians, and of course, that event inspired them with fresh confidence, and carried additional dismay throughout the whole frontier. It was necessary that the stain upon the American arms should be wiped off. A new army was raised, and the command entrusted to General Arthur St. Clair, who had distinguished himself highly in the war of the revolution. The result was looked forward to with intense anxiety; and the best hopes were entertained of success, from the known talents of the commander. The earnest wishes, however, of the whole nation, it is well known, were most cruelly disappointed. On the 4th of November 1791, near the Miami villages, the general and his brave army suffered a total defeat; it was, in truth, a complete massacre: sixty commissioned officers were killed or wounded, and one thousand privates slain on the spot. The gallant Brigadier-General Butler, the companion of Wayne in many of his feats of conduct and valour, was among the killed. It is easy to picture the dismay of the community on receiving the disastrous news. The Indian war became highly unpopular: and even the administration of the illustrious Washington suffered not a little in public estimation. A large quantity of money has been spent, besides the vast sacrifice of the lives of as noble troops as ever took the field. The anxiety, therefore, of the president, and of all well-wishers of their country, to select a commander who by his talents and energy was fitted to repair the wound the national honour had sustained, and to afford some kind of security to the harassed and exposed frontier, may be easily imagined. Washington did not hesitate an instant in the choice, and the senate immediately confirmed the appointment.

For all the exigencies of the service, Wayne was peculiarly fitted. Ardent, yet sufficiently cautious, experienced not only in the general science of war, but particularly so in contests with the wily and savage foe, untiring in his perseverance, hardy and brave as Cæsar, he was, of all the then distinguished officers in the United States, perhaps the most proper for the occasion. We have seen that he accepted the command with a full knowledge of its difficulties and dangers, and with a modest distrust of his abilities, which only served to render him the more cautious and vigilant.

On the 25th of May 1792, the general was furnished by the secretary of war with his instructions, in which he was emphatically told, what he knew full well beforehand, "that another defeat would be inexpressibly ruinous to the reputation of the government." He repaired to Pittsburgh, after taking leave of his family and friends, which place had been selected as the rendezvous of the troops. A new army was to be raised and organized; new officers to be obtained; the old force had been completely annihilated; the old officers had been killed or had resigned their commissions. The labours of the commanding general was, of course, proportionably increased. This, however, was a duty which, in the space of his long and faithful services to his country, Wayne had been required frequently to perform. At the breaking out of the revolution it was his duty and his pleasure to convert the raw, undisciplined yeomen into regular troops; and now he resumed the task with the same earnestness and cheerfulness, under the orders of his independent country. Many of the officers, not to mention the soldiers, had yet to learn the rudiments of their profession. Every thing, therefore, devolved upon the general. Military tactics, discipline, the organization of the army, all required his constant and persevering personal attention. His efforts were indefatigable, and the obstacles he encountered would have deterred one less determined than himself to redeem his country's reputation.

The country was completely panic-struck; an engagement with the Indians was regarded as identical with defeat. The greatest difficulties, therefore, existed in obtaining recruits. They marched, almost with horror, to the place of rendezvous, and seemed to consider themselves as on the way to instant destruction. When arrived at head-quarters, the greatest trouble and care were necessary to prevent desertion. It was impossible to guard against it completely, and this delayed considerably the formation of the army. Often the very sentries would desert their posts, and leave the most accessible places unguarded. The general, however, introduced a different scene, as soon as his salutary measures had time to go into operation. The troops were constantly exercised in all the usual evolutions, and also in such as were supposed to be most appropriate to the peculiar warfare they were about to undertake. They were taught daily to fire at a mark, and rewards were given to the best marksmen. A generous emulation was excited between the infantry and the riflemen. The latter were instructed in the importance of quickness as well as accuracy, and the former were led to place implicit confidence in the use of the bayonet. Instruction in the broadsword exercise was also imparted to the dragoons; and the artillery were not omitted in the attention which the general bestowed on every department of the service. The troops were taught to charge in open order, each individual relying on himself, and prepared for a personal conflict with the savage foe.

These varied and necessarily tedious preparations, together with the extreme slowness and hesitation with which the recruits came in, occupied the entire season; which, however, was not suffered to pass over by the general without obtaining information of the strength and disposition of the hostile Indians. Efforts were made to induce them to consent to an honourable peace; but they repelled all advances, and even went so far as to barbarously murder the two officers who were sent to them with a flag of truce.

The army wintered about twenty-two miles below Pittsburgh, on the Ohio, at a place named Legionville. Being anxious to conciliate the powerful tribe of the Six Nations, Wayne sent for two of their distinguished chiefs, Cornplanter and New Arrow, to pay him a visit. These persons professed to be very friendly towards the United States, and yet gave some evidence of what might be the views of the *hostile* Indians, when even *they* insisted upon confining the Americans to the east bank of the Ohio river. "My mind and heart," said Cornplanter, "are upon that river; may that water ever continue to run and remain the boundary of lasting peace between the Americans and Indians on its opposite shores." It was evident from these ridiculous and unjust pretensions (unjust because repeated treaties and fair purchase had confirmed to the states much land west of that river), that British emissaries were at work, labouring to plant these notions in the minds of the Indians: subsequent disclosures made the fact perfectly obvious.

On the 30th of April 1793, Wayne departed from Legionville, with an army disciplined to his entire satisfaction, and which, owing to his judicious plan of operation, had perfect confidence in itself. He had adopted the very wise and creditable determination of banishing whiskey entirely from his camp; he justly denominated it a baneful poison.

In six days the army arrived at Fort Washington, near the village, now the city of Cincinnati, and took up a position about a mile below that place. The government was still exceedingly anxious, if possible, to bring the war to a close without the necessity of a battle. General Wayne was, therefore, delayed in his operations by the positive orders of the president. The people of the United States were adverse in the extreme to an Indian war, and to comply with their known wishes in this respect attempts were again made at negotiation. A very highly respectable commission was sent forward to treat with the Indians. But their pretensions continued to be so extravagant, still insisting upon the Ohio as their boundary, and refusing to enter into negotiations except on that basis, that but one course was left. It remained for the power of the sword to settle the controversy, and General Wayne accordingly was directed to do the utmost in his power to render the result favourable to his country; being again told by the secretary at war that a defeat would be pernicious in the highest degree to her best interests. The secretary proceeded to say: "Your arrangements having been prepared for this event, if no unforseen circumstances should occur to prevent your proceeding, nothing further remains, but to commit you and the troops employed under you to the protection of the Supreme Being: hoping you and they will have all possible success in the measures you may be about to undertake, to prevent the murder of helpless women and children."

The correspondence that passed between General Knox, the secretary of war, and Wayne, during this period of highly excited interest, is extremely interesting, and reflects the utmost credit upon both those gentlemen.

In conformity with the powers vested in him, Wayne, having called for a reinforcement of a thousand mounted men from Kentucky, advanced and took up a position further in the enemy's country. His object was to keep the savages in check, and then to strike with effect when a favourable opportunity presented itself. He assured the secretary of war that, knowing the critical situation of his infant country, and feeling for the honour and reputation of the government, which he pledged himself to support with his latest breath, he would in no way commit his legion unnecessarily, and unless powerfully supported, would content himself with securing the frontier and protecting the posts and army during the winter. The troops in the autumn had suffered not only with the fevers usual to the season, but had been visited with the influenza and the small-pox.

During the remainder of the autumn and part of the winter, he contented himself with a further advance into the country, securing his army carefully as he proceeded; anxious to receive further directions from the war department, with which his communications, on account of his great distance, were very unfrequent. In the middle of winter he sent a strong detachment to the fatal battle-ground, where so many of the heroes of St. Clair's army had unfortunately perished, in order to erect a redoubt, collect the scattered bones of those unfortunate men, and pay the last honours to their memory. The enterprise was successful; and a pleasure, yet not unmixed with mournful recollections, was derived from the opportunity of rendering these last sad offices to the remains of the illustrious dead.

The cunning foe, under pretence of opening negotiations for peace, but really with the design of prying into the situation of the general's forces, sent him a pacific message. Anxious, as he knew the government to be, to secure a peace, though he distrusted the sincerity of their professions, Wayne did all in his power to produce the desired result. At one time, appearances seemed so much to justify the expectation of an amicable settlement, that Big-Tree, a Seneca warrior of high standing, who, from his friendly feelings towards the country had joined the army, in a fit of exasperation at the thought of peace, committed suicide. "I have lost" said he, "a very dear friend, the friend of my heart, General Richard Butler." He had sworn to sacrifice three enemies to the manes of his departed friend, and seeing his chance of revenge most probably at an end, he killed himself.

Upon the approach of spring affairs assumed a most interesting aspect. The British had established a fortified position within the limits of the territory of the United States. This, together with Lord Doncaster's speech to the Indians, the refusal of the British government to deliver up the posts, and the spoliations upon American commerce, all gave indications of a disposition on the part of that power to renew the war. Surrounded as the American general was with difficulties, it was a source of high gratification to him to receive the full approbation, as he did, of his own government, of all his measures. Confiding fully in his caution and valour, they entrusted him with the delicate task of taking, if he thought it necessary, the British post above referred to, and thus of involving the country, perhaps, in a war with England.

In the month of June, a small escort, under the walls of Fort Recovery, was attacked by a powerful body of Indians, assisted by British auxiliaries. They were repulsed with great loss; and thus, on the very ground of their former victory, the Indians were taught, under different auspices, to know and feel the superiority of the American arms. This successful skirmish inspired the army generally with the greatest confidence.

Towards the latter end of July, the mounted volunteers from Kentucky, whose assistance had been required by the general, arrived; and every preparation having been made, which a prudent foresight could suggest, on the 8th of August Wayne made a rapid advance into the very heart of the Indian settlements. So quick was the movement, and so judicious the direction which the general had selected (being towards that part of the country where the Indians fancied themselves secure, under the protection of the British fort), that had it not been for the treachery of a soldier, the enemy would have been taken completely by surprise. Thus the grand emporium of the hostile Indians in the west was taken possession of without loss of blood. Being himself a practical engineer, Wayne erected a fortress, which he named Fort Defiance, at the confluence of the Au

Glaize and the Miami. Before striking the decisive blow, however, impelled by his natural humanity, the general determined to make one more and last effort to avert the effusion of blood. Should that effort be as the rest had been, fruitless, he said, in a letter to General Knox, "their blood must be upon their own heads. America shall no longer be insulted with impunity. To an all-powerful and just God I therefore commit myself and gallant army." Confidently relying on their own strength, the savages resolved to try the chances of battle. It almost immediately followed. The engagement occurred on the 20th of August 1794, on the banks of the Miami, at the foot of the rapids.

At eight o'clock in the morning, the army advanced in columns, the legion on the right flank, covered by the river, a brigade of mounted volunteers on the left, under the orders of General Todd, and another in the rear under General Barbee; and a select batallion of the same volunteers moved in front of the legion, commanded by Major Price, and advanced sufficiently far to give timely notice to the main body of the attack of the enemy. After marching about five miles, this corps received so severe a fire from the enemy, secreted in the wood, that it was forced to retreat.

The legion was immediately formed, partly in two, and partly in three lines, in a close thick wood, which extended for miles. It was soon evident that the enemy were in full force in front, and were endeavouring to turn the left flank of Wayne's army. The mounted volunteers were, therefore, ordered to gain and turn the enemy's right flank, by a circuitous rout; and the second line was ordered to advance and support the first. The front line itself was directed to push on, with trailed arms, and expel the Indians from their coverts, at the point of the bayonet, at the same time that an attempt was made upon their left flank, next the river, with the legionary cavalry. All these different orders were obeyed with the greatest alacrity and spirit; but such was the impetuosity of the charge by the front line, that though the others made all the expedition possible, they hardly came in time to participate in the battle. The front line actually drove the enemy, though double their numbers, through the woods, for a distance of two miles. Full two thousand of the Indians and their auxiliaries were in the engagement; while on the American side, those actually engaged did not exceed nine hundred. The savages and their allies abandoned the field, and dispersed themselves with the utmost terror and dismay; all this occurred in sight of the very British garrison, under the protection of whose guns they vainly thought they could insult the American eagle with impunity.

The loss of the enemy was more than double that of the federal army. The woods were strewed to a considerable distance with the dead bodies of the Indians and their white auxiliaries, who were armed with British muskets and bayonets. The army remained in its position three days and nights, destroying the houses and corn-fields, within pistol-shot of the English fortress, the garrison of which was forced to remain quiet spectators of the conflagration, though among the houses burnt, was one with the stores and property of Col. M'Kee the British Indian Agent, who had been the principal instigator of the war between the United States and the savages.

The loss that General Wayne sustained, in both killed and wounded, was but one hundred and seven men. A spirited correspondence ensued between him and the commander of the British fort, and the general was exceedingly anxious that the result should be such as would justify to the whole world the capture of the fort, which he was ready, in a moment, to undertake; but the English colonel, from the specimen he had witnessed of the prowess of the American arms, was particularly cautious how he conducted himself at that time, both in word and deed; and Wayne was therefore forced to content himself with the destruction we have referred to of the savage property, under their very guns, and in a way to show that the savages could derive no protection from them. After effectually strengthening Fort Defiance, the army took up its line of march, and on the 17th of September, having arrived at the Miami villages, shortly after went into winter-quarters at Greenville.

The most decisive and happy effects were speedily produced by this victory. The proud and uncompromising spirit we before alluded to, and which rejected every offer of accommodation, was completely humbled. The superiority of the American arms was made manifest, and the savage warriors came forward and sued submissively for peace. On the 1st of January 1795, preliminary articles were entered into, and hostages were left with the general, for the purpose of procuring the safe return of such as were prisoners with the Indians. But the good effects of this important victory were not confined to the immediate benefits which it imparted to the inhabitants of the western frontiers. It is known that the voice of faction reached such a height as to embitter even the administration of the father of his country; the disastrous defeats of the generals before mentioned, had given some handle to his enemies for the opposition which they were waging against him. The impunity which had attended the ravages of the Indians on the Ohio, had almost kindled into a flame the sparks of hostility among the tribes of the Six Nations, and also the southern tribes bordering on Georgia. By the glorious result of Wayne's campaigns, all were happily settled; the voice of faction was stilled; the gathering hostility of the Indian tribes referred to was crushed in the bud. Mr. Jay was, at that time, in the act of negotiation with the British government; the news passed the Atlantic, and contributed materially to the termination of his treaty.

The president immediately issued a commission appointing the general sole commissioner, with full power to negotiate treaties with all the Indians north and west of the Ohio. In the negotiations entered into in pursuance of this authority, General Wayne was called upon to exhibit new qualifications. The characteristics of the statesman were now demanded, and Wayne displayed all the highest requisites of the negotiator. Calm and determined, ingenuous, frank and open, he explained, enforced and maintained the views of his own government, and while he fully impressed the Indians with the fact that the United States were perfectly prepared for war, yet he assured them that they earnestly desired peace on equitable terms. He fully succeeded; and it is said that, at the close of the negotiation, those "proud and fierce sons of the forest cherished a respect for the American *commissioner* in council, as sincere as the dread they entertained of the *general* in the field." The definitive treaty of peace was signed on the 3d of August 1795, and the parties separated mutually satisfied and pleased. A restoration of prisoners took place, which was the source of great gratification.

This treaty met the entire concurrence and approbation of the general's own government. It and the previous victory were hailed with universal joy by the whole country. The name of Wayne was in every mouth, and coupled with expressions of the most heart-felt gratitude. Congress adopted, unanimously, resolutions in the highest degree complimentary to the commander and his gallant army; and President Washington personally conveyed to him the sentiments of his warmest esteem and approbation.

Peace being thus proclaimed, the general returned to visit his family and friends, after an absence of several years, passed in unremitted labour and exertion. On the 7th of February 1796, he entered Philadelphia, under circumstances that gave to his arrival all the marks of a public triumph. The shops of the city were closed; the bells sounded forth the notes of welcome; the military companies of the place and its neighbourhood turned out to greet him, and he was received, universally, with the hearty congratulations of his fellow-citizens of every description.

While all things wore this appearance of triumph and rejoicing, circumstances occurred in the West to throw a damp, for a time, upon the general joy. The British treaty was received by no means with universal approval. A strong party was enlisted against its ratification; many supposed that war would again ensue. Emissaries from Canada were at work among the Indians, and additional apprehension was excited by the conduct of the Spanish Governor of Louisiana. By Jay's treaty, the British posts at Detroit, Michilimackinac, Oswego and Niagara, were to be surrendered immediately to the United States, and it was necessary to appoint a commissioner to superintend the delivery; one in whom the government had full confidence. Under these circumstances, then, General Wayne was directed to return to the western country; and he was clothed by the executive with extensive discretionary powers. When he arrived at the place of his destination, he was received by the savages with the greatest pleasure and respect, and by his presence, and the arrest of some emissaries, which he very soon took measures to direct, order and tranquillity were happily preserved.

Fortunately for the good and peace of the United States, congress ratified the treaty with Great Britain, and voted the appropriation to carry it into effect: and the surrender of the posts into the hands of General Wayne completed the settlement of the difficulties which the government laboured under in that quarter. The territory north and west of the Ohio, which had been the scene of so much commotion and bloodshed, forms now one of the most beautiful and peaceful spots of the mighty empire of the federal union. It is part of the great valley of the Mississippi, whose resources, magnificent as they have appeared, are but partially developed. The astonishing increase of that section of country is well known, and has set at defiance all known rules of progression in population. In 1790 it contained only 3000 white inhabitants; in the year 1800 the number had risen to 50,000; in 1810 to 250,000; and now millions dwell on its bosom.

Having placed matters upon the best possible footing, and done all that the exigencies of the case demanded, in the month of November General Wayne sailed from Detroit for Presque Isle, which was the last post within his circuit of duty, previously to his return to the seat of government. This, most unexpectedly to himself and his friends, was the last journey on earth that he undertook. On his passage, he was seized with an attack of the gout, upon the 17th of November, the day before he landed. It continued with considerable violence until the 30th, when it apparently subsided, but in a few days returned with increased force, and on the 15th of December 1796, terminated the life of one of the greatest and best amongst American soldiers and patriots.

He died in the vigor of his life, and in the midst of his usefulness. He was sixteen days less than 52 years of age at the time of his decease, and just at that period of life when experience, the gift of mature years, would have proved a powerful addition to a character in every respect most estimable. His remains were temporarily deposited at the place where he died, and were removed thence, in the year 1809, by his son, to the cemetry of St. David's church, near Waynesborough farm, in the county of Chester, Pennsylvania, where he had been born, and where for many years of his life he had peacefully resided. A handsome monument was reared to his memory by the Pennsylvania State Society of the Cincinnati, with the following inscription:—

In honour of the distinguished
Military Services of
Major-General
ANTHONY WAYNE,
And as an affectionate tribute of respect
to his memory,
This stone was erected by his
Companions in arms,
The Pennsylvania State Society of
The Cincinnati,
July 4th, A.D. 1809,

Thirty-fourth Anniversary of
The Independence of
The United States of America;
An event which constitutes
The most
Appropriate eulogium of an
American
Soldier and Patriot.

The character of Anthony Wayne, as a soldier and a general, stands forth in such bold relief from the pages of his history, that probably a statement of his peculiar merits in those particulars may be considered superfluous repetition. To say that he was bold, ardent, undaunted and persevering in the onset of battle, and extremely cautious and skilful in his previous preparations, is but to narrate what the reader has seen exhibited in every instance of his active military career. These are qualities which are not always found united in the same individual; on the contrary, the majority of those who are the bravest and the most impetuous in the fight, are generally the least qualified for the cool and calm reflections which are the parent of cautious preparation; and the head that can the best plan, is not always accompanied with either the stoutest heart or the steadiest hand. The whole of General Wayne's military life is an evidence of his being an exception to the truth of this remark.

To say that he was brave, is perhaps to add nothing to a soldier's reputation; but Wayne's courage was not merely an indifference to personal safety, or a disregard of personal comfort, but it was a bravery, or rather a moral magnanimity, which circumstances could not appal or daunt; and which, happily, in his case, was conjoined with an intelligence and ingenuity, that enabled him to surmount what, to a less hardy spirit, would have appeared impracticable. But the ordinary and usual merits of a commander were possessed by General Wayne in company with other and rarer attachments. His early education had fortunately made him a practical man. He was a mathematician, and knew how to apply that useful science to the necessary business of life. What his science suggested as advantageous, and what his head had planned, he could, with his own hand, practically perform; and there were many occasions in the course of his command when he was called upon to put these acquirements in use. The tactics of war were perfectly familiar to him. He was a thorough disciplinarian and tactician; and he could personally attend to the drilling of his troops as well as to their disposition on the eve of battle. The duties of the corporal and the sergeant, in the vicissitudes of war, were as often performed by him as those of the commanding general.

> " But softer honours, and less noisy fame,
> Attend the shade of gentle Buckingham."

It was not merely for the more commanding traits of character, or for those qualities which bring their possessor prominently before the public eye, that Wayne is entitled to be remembered and eulogised. For the characteristics which lend a charm to social intercourse, and without which the grandest qualifications appear rough and repulsive, Wayne was eminently conspicuous. His polished manners and his courteous conduct qualified him to shine in society, and procured him everywhere friends; while his affectionate disposition and warm feelings made him fondly attached to and beloved by his friends. The imperious calls of duty frequently separated him from those in whose society he took the highest and the purest pleasure; and to show that absence had no effect in weakening the strength of his domestic attachments, we shall extract a part of a letter to his daughter Mrs. Atlee.

"You were both (meaning his only son and daughter) infants, when I was first called upon by my country to defend her rights and liberties; in which hazardous task I spent my prime of life, nor was I sparing of my blood. At the close of the late war, from the vicissitudes of fortune we were again separated, and at a period when fortune, tired of her persecution, began to smile upon me, and promised ease and retirement, I was again called forth to form and lead her legion, which had yet to learn the dreadful trade of death, against a victorious and insulting savage foe.

"From these causes have we been separated from each other, and from these causes has an affectionate and an indulgent parent been lost, and almost a stranger, to his children and family."

General Eaton, who was a captain under the orders of Wayne, in the campaign against the Indians, and who so distinguished himself in Africa, has recorded the following character of his general.

" He is firm in constitution as in resolution; industrious, indefatigable, determined and persevering; fixed in opinion and unbiassed in judgment; not over accessible, but studious to reward merit. He is a rock against which the waves of calumny and malice, moved by the gusts of passion natural to envy, have dashed; have washed its sides; he is still immovable on his base. He is, in some degree, susceptible of adulation, as is every man who has an honest thirst for military fame. He endures fatigue and hardship with a fortitude uncommon for a man of his years. I have seen him, in the most severe night of the winter of 1794, sleep on the ground like his fellow soldiers, and walk around the camp at four in the morning, with the vigilance of a sentinel."

The pen of an acquaintance thus describes his personal appearance. " He was above what is commonly termed " the middle stature, and well proportioned. His hair was dark; his forehead was high and handsomely formed; his eyes were dark hazle, intelligent, quick and penetrating; his nose inclined to the aquiline: the remainder of his face was well proportioned, and his whole countenance fine and animated."

The same writer remarks, " The natural disposition of Mr. Wayne was very amiable; he was ardent and sincere in his attachments, his morals were chaste, and his manners refined."

Wharton.

WAYNE, northeastern county of Pennsylvania, bounded S.E. and S. by Pike county; S.W. by Luzerne; W. by Susquehanna; N. by Broome county, state of New York; and by Delaware river separating it from Delaware county, New York, N.E. The greatest length of Wayne county Pennsylvania, is along its western border 54 miles, in common with Luzerne and Susquehanna counties, mean breadth 12, and area 648 square miles; extending in Lat. from 41° 13′ to 42° N., and in Long. from 1° 30′ to 1° 58′ E. from W. C. The general declivity is eastward towards Delaware river. The southern and central sections, embracing full two-thirds of the whole area, are drained by the various creeks of Lackawaxen river. The western border along the Lackawannox mountain gives source to the higher sources of Lackawannox river flowing southwestwardly into Susquehanna river in Wioming valley, and to the Starucco creek flowing northwestwardly in the Susquehanna at the head of the Great Bend. The northeastern part is drained into the Delaware by numerous short creeks above the Lackawaxen river. The surface is either mountainous or hilly, with, however, much excellent soil. Though bordering on the Delaware river, Wayne county is comparatively a new settlement. In 1820 it contained but 4127, but in 1830 the population had risen to 7674, having gained 86 per cent in 10 years. For the causes of such prosperity, see Lackawaxen, Honesdale, and Carbondale. Chief towns, Bethany, seat of justice, Honesdale, Damascus, and Stockport.

WAYNE, county of North Carolina, bounded E. by Pitt; S.E. by Lenoir; S. by Duplin; S.W. by Sampson; W. by Johnson; N. by Nash; and N.E. by Contentny creek separating it from Edgecombe. Length 36, mean breadth 20, and area 720 square miles; extending in Lat. from 35° 12′ to 35° 41′ N. and in Long. from 0° 51′ to 1° 21′ W. from W. C. Wayne county of North Carolina is entirely in the valley of Neuse river. Declivity S.E. by E. The main stream of Neuse enters from Johnson county, and passing Waynesborough, divides Wayne county into two unequal sections. Population in 1820, 9040, in 1830, 10,331. Chief town, Waynesborough. By the post-office list of 1831, this county contained post-offices at Nahunta, Springbank and Waynesborough.

WAYNE, county of Georgia, bounded by Glynn E., Camden and Ware S.W., Appling N.W. and Alatamaha river separating it from M'Intosh N. Length 45 miles, mean breadth 16, and area 720 square miles. Extending in Lat. from 31° 7′ to 31° 44′ N., and in Long. from 4° 44′ to 5° 18′ W. from W. C. Declivity southeastward, in the direction of the courses of Alatamaha and Santilla rivers. The latter stream traverses the south western parts of the county. Surface generally low, flat and in part marshy. Chief town Waynesville. Population in 1820, 1010, and in 1830, 963.

WAYNE, county of the state of Mississippi, bounded by Greene S., Perry S.W., Jones W., the Choctaw country N., and Washington county of Alabama E. Length 32, mean breadth 28, and area 896 square miles. Extending in Lat. from 31° 26′ to 31° 53′ N., and in Long. from 11° 37′ to 12° 5′ W. from W. C. This county declines to the southward, and is drained in that direction by the Chickasawhay river. The general surface pine forest, moderately hilly, with sterile soil. Chief town Winchester. Population in 1820, 3323, and in 1830, 2781.

WAYNE, county of Tennessee, bounded W. by Hardin, N. by Perry, N.E. by Hickman, E. by Lawrence and S. by Lauderdale county Alabama. Length 24, mean breadth 21, and area 504 square miles. Extending in Lat. from 35° to 35° 20′ and traversed by the 11th degree of Long. W. from W. C. Tennessee river sweeps in a semicircle round Wayne, and touching it on the northwestern angle, receive from its creeks like radii from a common centre. The surface hilly and soil good. Population in 1820, 2459, in 1830, 6015. Chief town Waynesborough. By the post-list of 1830 there were offices in this county at Carrollville and Waynesborough.

WAYNE, county of Kentucky, bounded by Cumberland county, same state, W., Cumberland river separating it from Russell N.W., and Pulaski N., Whitley E., Morgan county in Tennessee S. Length 40, mean breadth 22, and area 880 square miles. Extending in Lat. from 36° 36′ to 37° N., and in Long. from 7° 16′ to 8° W. from W. C. Declivity a little W of N. towards Cumberland river, and drained in that direction by the south fork of the Cumberland and some other streams. Chief town Monticello. Population in 1820, 7951, in 1830, 8731. By the post-office list of 1831, there were post-offices at Berry's, Millsprings and Monticello.

WAYNE, county of Ohio, bounded E. by Stark, S. by Holmes, W. by Richland, N.W. by Lorain, and N.E. by Medina. Length from E. to W. 30 miles; breadth 24, and area 720 square miles. Extending in Lat. from 41° 40′ to 42° N., and in Long. from 4° 42′ to 5° 15′ W. from W. C.

This county occupies a part of the table land of the state of Ohio, though the far greater part of the surface inclines to the southward, and is drained by the sources of the Muddy Fork of Mohiccon, Killbuck, and Sugar creeks, tributaries of Muskingum. The surface is rather level than hilly or rolling. Soil, similar to other parts of the Ohio table land, is generally fertile.

Wooster, a post town and the seat of justice of this county, is by post road 347 miles N.W. by W. from W. C., and 86 miles N.E. from Columbus. It is situated towards the head of Killbuck creek, at N. Lat. 40° 48′ and Long. 4° W. from W. C.

WAYNE, county of Michigan, bounded S. and S.W. by Monroe, W. by Washtenaw, N.E. by Macomb and the western part of St Clair river, and E. and S.E. by Detroit river. Greatest length along the northern boundary 38 miles, mean breadth 20, and area 760 square miles. Extending in Lat. from 42° 07′ to 42° 26′, and in Long. from 5° 48′ to 6° 30′ W. from W.C.

This fine county slopes southeastwardly towards Lake Erie and Detroit river, and is drained in that direction by Huron river of Lake Erie, and the Riviere Rouge. The surface is generally level or undulating; soil productive. Population of the county 1830, 6771.

Detroit, a post town and the seat of justice for this county and of the government of Michigan, stands on the right or western bank of Detroit river, by post road 526 miles a little W. of N.W. from W. C.; two miles a little E. of N. from Sandwich in Upper Canada, and about 200 miles very nearly due N. from Columbus in the state of Ohio.

The situation of this cradle of civilized settlement, so far to the westward on the Canadian sea, is highly advantageous. The river is navigable for vessels drawing eight or nine feet water. The harbour, already supplied with extensive wharves, has the appearance of a seaport. The city is solidly and not slowly advancing in population, wealth and science. The buildings are many of them elegant and generally neat; the streets extend at right angles to each other; the site is a gently rising plain. Population in 1830, 2222.

WAYNE, county of Indiana, bounded S. by Union county, S.W. by Fayette, W. by Henry, N. by Randolph, N.E. by Darke in Ohio, and S.E. by Prebble in Ohio. It is very nearly a square of 20 miles each side, or 400 square miles; extending in Lat. from 39° 43′ to 40° 02′, and in Long. from 7° 50′ to 8° 12′ W. from W. C. The slope of this county is a little S. of W., and in that direction is drained by the sources of Whitewater river. Population 1830, 18,571.

Centreville, the seat of justice, is by post road 510 miles N.W. by W., ½ W. from W. C., 63 miles E. from Indianopolis, and about 100 miles W. from Columbus in Ohio. N. Lat. 40° 02′, Long. 8° W. from W. C.

WAYNE, county of Illinois, bounded S.E. by White, S. by Hamilton, S.W. by Jefferson, N.W. by Marion, N. by Clay, and E. by Edwards. It is very nearly a square of 24 miles each side, 576 square miles; extending in Lat. from 38° 17′ to 38° 38′, and in Long. from 11° 18′ W. to 11° 44′ W. from W. C. The slope is towards the S.E. and drained by Wayne's Fork of Little Wabash. Population 1830, 2553.

Carmi, a post town and the seat of justice, is by post road 748 miles W. from W. C., and 94 miles S.E. from Vandalia.

WAYNE, county of Missouri. This extensive, but in great part uninhabited country, comprises a large share of the southern part of the state, giving source to numerous confluents of St Francis river, and of Black, Current's, and Spring rivers, tributaries of White river. Big North Fork of White river also rises within its limits. All these streams have a southern direction. The northern part of Wayne county, Missouri, extends over the intermediate table land, and discharges to the northwards the sources of Gasconnade, a tributary of Missouri and Merrimac, a small confluent of Mississippi. In 1830, this wide region, comprising an area exceeding 10,000 square miles, contained a population of 3264.

Greenville, a post town of this county, as laid down by Tanner, is situated on St Francis river, about 70 miles a little N. of W. from the confluence of Ohio and Mississippi rivers, 120 miles a very little W. of S. from St. Louis; by post road 908 miles, and geographically 13° 30′ W. from W. C. N. Lat. 37° 05′. Darby.

WAYWISER. See Odometer.

WEAKLY, county of Tennessee, bounded E. by Henry, S.E. by Carroll, S.W. by Gibson, W. by Obion; and by Hickman county Kentucky N.W; and Graves Kentucky N.E. Length 30, breadth 28, and area 840 square miles. Extending in Lat. from 36° 06′ N. to 36° 36′ N., and from Long. 11° 38′ W. to 11° 04′ W. from W. C. This county is entirely in the valley of Obion river, and the declivity westward towards the Mississippi. Chief-town Dresden. Darby.

WEATHER. See Meteorology.

WEAVING. See Carpet, Vol. V. p. 429. Chainwork, and Cloth Manufacture, Vol. VI. p. 535.

WEDGE. See Mechanics.

WEDGEWOOD, Josiah, the celebrated potter, was descended of respectable parentage, being a younger son of a person of the same profession in Staffordshire,—and was born in the month of July 1730. His education was not very liberal; and his patrimony was small; but no circumstances could easily have retarded his genius or extinguished that activity of mind for which through life he was distinguished. Till his time, the manufacture for improvements and inventions in which he became so eminent, had made little progress in Britain, though it had been introduced for a considerable time. (See the articles Porcelain and Pottery in this work.) He made improvements, with regard to form, colour and composition, in every species of earthenware made before his day; and he invented others. In 1763, he invented a new species of ware for the table, known by the name of Queen's ware, because patronized by her late majesty. It was formed of clay got from Devonshire and Dorsetshire, mixed with ground flint, and covered with a vitreous glaze. This step, though a great one, was only the first in his career of invention and improvement; in which, it may here be mentioned, he was much assisted by his respectable and talented partner, Mr. Bentley, as also by Mr Chisholme, a chemist of considerable eminence, on whom he bestowed liberal remuneration, and of whose scientific services he amply availed himself. By varying and repeating his experiments in regard to Queen's ware, he discovered modes of making other species of pottery and porcelain, equally elegant and useful. Of these, the most important are the following: I. a species resembling porphyry, Egyptian pebble and other beautiful stones of the siliceous or crystalline kind. II. Jasper, a white porcelain which rivalled the productions of antiquity, which was soon known throughout Europe: it was possessed of properties similar to the natural stone of the same name, susceptible of a high polish, resisting all the acids, and bearing with impunity a very strong fire; together with the singular property of receiving from metallic calces, the same colours which those calces impart to glass or enamels in fusion; a distinction possessed by no porcelain of ancient or modern composition. III. Basaltes, a black porcelain biscount, which, like the preceding, bore a strong similarity to the natural stone, could receive a fine polish, resist the acids, and bear, without injury, a very strong fire. IV. White porcelain biscuit, of a smooth waxlike appearance, of properties similar to basaltes. V. Bamboo, a cane-coloured substance, resembling, in its characteristics, the kind last described. VI. A porcelain biscuit, remarkable for its hardness, similar to that of agate; a property which, with its impenetrability by acids and every known liquid, makes it peculiarly well adapted for the formation of mortars and other chemical vessels.

His famous imitation of the Barberini vase, discovered in the tomb of Alexander Severus, may here be mentioned. The imitation was so perfect, that the late Duchess of Portland paid him 1000 guineas for it; from which circumstance it has obtained the name of the Portland vase. He obtained subscriptions of £.50 each for 50 similar vases; which were manufacted accordingly; but so expensive was the execution of them that he really was a loser by the speculation: the modeller got no smaller a sum than 500 guineas for his part of the work. Nor should we omit mentioning two celebrated Cameo's of Mr. Wedgewood's manufacture; one of a slave in chains, exquisitely formed, with the inscription, "Am I not a man and a brother?" of which he distributed many hundreds, to excite the public interest in the abolition of the slave trade: the other consisted of a figure of Hope, attended by Peace, Art and Labour, composed of clay from Botany Bay, to which colony he sent many of them to show the inhabitants what the materials of their country could produce, and to stimulate their industry. (See *Philosophical Transactions* for the year 1786, p. 667.)—Among other things, it may also be stated, that Wedgewood made great improvements in the potter's lathe, and in the machinery for reducing the clay to powder, and for separating the grosser parts from the fine.

Nor is Mr. Wedgewood known merely for the improvements and inventions of which we have been giving an account. His studies embraced chemistry and general science; and he is particularly celebrated as the inventor of a pyrometer for measuring intense heat; a valuable and ingenious instrument, of which a minute description may be found under the articles HEAT, CHEMISTRY and PYROMETER in this work. An account of his experiments connected with it may be found in the Transactions of the Royal Society (of which he was a distinguished member), for the years 1782-3-4. It may be here stated that he was long a member also of the Antiquarian Society.

Mr. Wedgewood thus, both in his own profession and as a man of science, raised the manufacture with which he was connected to that eminence which it still maintains. Porcelain and pottery wares, instead of being imported as before his time, now form a considerable branch of our export trade, and are universally prized. The Potteries, the seat of these manufactures in Staffordshire, have increased more rapidly in population than any other district of the empire, and are now the most densely inhabited spot in Britain.

Mr. Wedgewood died at Etruria, his seat in the Potteries, in January 1795, in the 65th year of his age, leaving behind him a name equally respectable and eminent. His private character, indeed, was peculiarly amiable: he was charitable, liberal, a great patron of science and learning, friendly, affectionate. Works of public utility ever commanded his interest and his services; and the ample fortune which he had amassed, afforded him the means of gratifying his liberal and patriotic spirit. It was chiefly through his means that the Grand Trunk Canal, which connects the Trent and the Mersey, was projected and constructed. It only now remains to be mentioned, that as a manufacturer he was succeeded by his two sons, who carry on the business with talent, and to an extent worthy of their descent. (T. M.)

WEIGHING MACHINE is the name given to a machine for ascertaining the weight of loaded carts, &c. It is nothing more than a sort of compound steelyard, the shorter arms of which are placed in a pit on the ground, so that the cart can be made to rest by its wheels at a given distance from the fulcrum. Weights are then placed on the long arm, which indicate the weight by the distance at which a given weight is placed from the fulcrum. See DYNAMOMETER.

WEIGHTS.

A general account of English weights has been given in our article ARITHMETIC, Vol. II. p. 345, and of French ones, in the article FRANCE.

Although the weights and measures of Scotland were assimilated to those of England by the Act of Union, yet so imperfectly was this assimilation effected, that before the passing of the last bill, there were about *thirty* different systems of weights and measures in Scotland.

The English Troy weight and Apothecaries' weight were used in Scotland in the same manner nearly as in England, with this exception only, that the Scotch jewellers divided the Troy oz. into 16 drops, each drop being 30 Troy grains.

In Scotland the English avoirdupois weight was used for leather, soap, sugar, tea, candles, flour and groceries, and also for resin, wax, pitch, wrought metals, some Baltic goods, and all goods imported from England.

Another kind of Troy weight was used in Scotland, called *Dutch* weight, and sometimes *Amsterdam*, and *French* weight, for weighing iron, hemp, flax, Baltic and Dutch goods, meal, butcher's meat, unwrought pewter and lead, &c. One stone or 16 lbs. of this weight as used in Glasgow, is = 17.442482 imperial avoirdupois lbs. = 279.0797 ditto oz. = 4465.27 ditto drams = 122097.978 ditto grains. Hence *eleven* pounds Dutch weight are very nearly equal to *twelve* pounds imperial avoirdupois, or the Dutch exceeds the imperial avoirdupois weight by a little more than 9 per cent.

The Tron weight formerly used in Glasgow for fish, cheese, and butter, is equal to 22 oz. 7 dr. old avordupois, or to 22.4439 imperial avoirdupois. The Tron pound is = 1.40274 imperial avoirdupois lbs.

The English weight consists of *Troy* and *Avoirdupois* weight, both of which were derived from a certain number of grains of wheat. The grains must be gathered from the middle of the ear, and 32 of these grains form one dwt. Troy.

The unit of weight is the brass weight of 1 lb. Troy in the custody of the clerk of the House of Commons. It was made in 1758, and contains 5760 grains; and it has been proved that 1 cubic inch of distilled water, weighed in air by brass weights at the temperature of 62° Fahrenheit, and when the barometer stands at 30 inches, is exactly 252.488 of these grains. Hence 5760 of these grains are adopted for the imperial standard Troy lb. and 7000 for the lb. avoidupois.

The following table by Mr. Cleland, shows the relation of these two varieties of weights.

TROY.				AVOIRDUPOIS.		
Lib.	Oz.	Dwts.	Grains.	Lib.	Oz.	Drams.
1.	12.	140.	5769.	.822857	13.16571	210.6514
.083333	1.	20.	480.	.068571	1.09714	17.5543
.004167	.05	1.	24.	.003429	.05486	.8777
.000174	.00208	.0417	1.	.000143	.00229	.0366
1.215278	14.58333	291.6667	7000.	1.	16.	256.
.075955	.91146	18.2292	437.5	.0625	1.	16.
.004747	.05697	1.1393	27.34375	.003906	.0625	1.

In the preceding table all the numbers in the same line have the same value.

Table of ancient weights, according to Christiani and Arbuthnot.

		Eng. Gr.
Attic Obolus,	Chr.	8.2
	Arb.	9.1
Attic Drachma,	Chr.	51.9
	Arb.	54.6
— Lesser Mina,	dr.	3892
— Gr. Mina, 100 dr.	Chr.	5189
	Arb.	5464
— Medical Mina,	Arb.	6994
— Talent = 60 minæ = ½ cwt. Eng.		
Old Greek drachma,	Arb.	146.5
Old Greek Mina,	Arb.	6425
Egyptian Mina,	Arb.	8326
Ptolemaic Mina of Cleopatria,		8985
Alexandrian Mina of Dioscorides,		9992
Roman Denarius, Chr. = ⅛ oz.		51.9
Arb. $\frac{1}{7}$ oz.		62.5
— Ounce, Chr.		415.1
Arb.=av. oz.		437.2
— Pound of 10 oz.		4150
12 oz.	Chr.	4981
	Arb.	5246

Table of Greek and Roman weights reduced to English Troy, (from Arbuthnot).

Ratios.	English Troy. Lb.	Oz.	Dwt.	Grains.
1 Lentes,	0	0	0	$0\frac{85}{42}$
4 Siliquæ,	0	0	0	$3\frac{1}{28}$
3 Obolus,	0	0	0	$9\frac{3}{8}$
2 Scriptulum,	0	0	0	$18\frac{3}{14}$
3 Drachma,	0	0	2	$6\frac{9}{14}$
$1\frac{1}{3}$ Sextula,	0	0	3	$0\frac{6}{7}$
$1\frac{1}{2}$ Sicilicus,	0	0	4	$13\frac{2}{7}$
$1\frac{1}{3}$ Duella	0	0	6	$1\frac{5}{7}$
3 Uncia,	0	0	18	$5\frac{1}{7}$
12 Libra,	0	10	18	$13\frac{5}{7}$

Table of ancient Roman weights reduced to English Troy weight from Paucton.

Ratios.	English pieces.
1 Siliqua Keration,	3
3 Simplium,	9
$1\frac{1}{7}$ Sextans of Celsus,	$10\frac{2}{7}$
$1\frac{3}{4}$ Scriptulum,	18
3 Denarius of Nero,	54
$1\frac{1}{7}$ Denarius of Papyrius,	$61\frac{5}{7}$
$1\frac{1}{6}$ Sextula,	72
$1\frac{1}{2}$ Sicilicus,	108
$1\frac{1}{3}$ Duella,	144
3 Uncia,	432
2 Sextans,	864
$1\frac{1}{2}$ Quadrans, triunx, teruncium,	1296
$1\frac{1}{3}$ Triens,	1728
$1\frac{1}{4}$ Quincunx,	2160
$1\frac{1}{5}$ Sexunx, semis,	2592
$1\frac{1}{6}$ Septunx,	3024
$1\frac{1}{7}$ Bes, bessis, des,	3426
$1\frac{1}{8}$ Dodrans nonuncium,	3888
$1\frac{1}{10}$ Dextans,	4320
$1\frac{1}{4}$ Deunx,	4752
$1\frac{1}{4}$ Mina, libra, as, ponda,	5184
Centumpondium,	518400

Table of Apothecaries Grains of different countries, from Vega.

	English grains.		English grains.
Austria,	= $\frac{5}{8}$ 1.125	Spain,	.925
Holland,	.989	Rome,	.909
France,	.981	Portugal,	.864
Hanover,	.978	Naples,	.860
Germany,	.959	Genoa,	.850
	.958	Piedmont,	.824
Bern,	.956	Venice,	.809
Sweden,	.955		

The two following tables of Dr. Kelly contain the most valuable comparison between the English Troy and Avoirdupois weights, and those of different countries.

Table I.—*Comparison of the Troy, or Gold and Silver weights of different countries.*

N.B.—The first column shows the number of pounds, marks, ounces, &c. of each place, which are equal to 100 lbs. English Troy, and column 2d shows the weight of a single pound, mark, ounce, &c. in English Troy grains.

Country.	Name of Weight.	W't of 100 lb. English Troy.	W't of a single lb. mark, &c. in English Grains.
Amsterdam	Marks	151.68	3797½
Antwerp	The same		
Augsburg	Marks	158.11	
Basle	(See *Cologne.*)		
Berlin	Marks	159.29	3616
Bern	Marks	151.18	3810
Bombay	Tolas	3232.32	177⅕
Bremen	(See *Cologne.*)		
Breslau	Marks	182.39	3158
Brussels	(See *Amsterdam*)		
Cadiz	(See *Spain.*)		
Cairo	Rottoli	86.56	6654
Calicut	Miscals	8347.82	69
China	Tales	993.79	579¾
Cologne	Marks	159.64	3608
Constantinople	Chekies	117.	4922½
——	Drams	11700.	49¼
Cracow	Marks	187.68	3069
Damascus	Metecals	8347.82	69
Dantzic	Marks	195.42	2947½
Denmark	Marks	158.89	3625
England	Troy pounds	100.	5760
——	ounces	1200.	480
Florence	Libre	109.90	5241
——	Ounce	1318.83	436¾
Frankfort	(See *Cologne.*)		
France	Marks	152.44	3780
——	Ounces.	1219.52	472
——	Kilogrammes.	37.31	15444
Geneva	Marks	152.15	3785½
Genoa	Libre	117.45	4904
——	Ounce	1409.40	408¾
Hamburgh	(See *Cologne.*)		
Hanover	(See *Cologne.*)		
Holland	(See *Amsterdam.*)		
Konigsberg	Marks	190.50	3023½
Leghorn	(See *Florence.*)		
Leipsic	(See *Cologne.*)		
Lubec	(See *Cologne.*)		
Madras	Seers	134.17	4293
——	Pagodas	10919.40	52¾
——	Rupees	3217.87	179
Malabar	(See *Madras.*)		
Malta	Libre	117.83	4888
Milan	Marks	158.75	3629
——	Ounces	1270.	453½
Naples	Libre	116.36	4950
——	Oncie	1396.32	412½
Nuremberg	Marks	156.95	3670
Pegu	Ticals	2426.82	233⅛
Persia	Miscals	8022.25	71½
Poland	Marks	185.	3113
Portugal	Marks	162.62	3542
Prague	Marks	147.09	3916
Ratisbon	Marks	151.68	3797½
Riga	Marks	178.43	3228
Rome	Libre	110.	5236
Russia	Pounds	91.23	6314
——	Solotnicks	8758.	65¾
Sienna	Libre	11122.	5178½
Spain	Marks	161.87	3557
——	Ounces	1294.96	444⅜
——	Castellanos	8093.50	17
Surat	Tolas	3066.55	187⅓
Sweden	Marks	177.12	3252
Tripoli	Metecals	7819.	73¾
Tunis	Ounces	1185.20	486
Turin	Marks	151.68	3297½
Venice	Marks	156.44	3682
Vienna	Marks	132.88	4334½
Zurich	Marks	159.27	3616¼

Table II.—*A Comparison of the Commercial Weights of different Countries with English Avoirdupois Weight.*

Country.	Name of Weight.	W't of 100 lb. Avoird.	Wt of a single lb. mark, &c. in English Grains.
Aix-la-Chapelle	Pounds	96.76	7234
Aleppo	Rottoli of 720 drs.	19.89	35190
——	Do. —— 700 drs.	20.46	34212
——	Do. —— 680 drs.	21.06	33235
——	Do. —— 600 drs.	23.87	29325
——	Okas 400 drs.	35.80	19550
Alexandria	Rottoli Forfori	107.	6542
——	Zaydini	74.90	9345
——	Zauri	48.32	14485
——	Mine	59.92	11682
Algiers	Rottoli.	84.	8330
Alicant	Great pounds	87.48	8002
——	Light pounds	131.20	5335
Altona	(See *Hamburgh.*)		
Amsterdam	Pounds	91.80	7625
Ancona	Pounds	136.05	5145
Antwerp	Pounds	96.75	7235
Apoth. Weight			
——	English pounds	121.52	5760
——	Dutch do.	122.89	5696
——	German do.	126.65	5527
——	French do. 1803	123.50	5668
Archangel	(See *Russia.*)		
Augsburgh	Heavy pounds	92.35	7580
——	Light pounds	95.95	7295
Aurich	Heavy pounds	83.	8433
——	Light pounds	91.10	7666
Bamberg	Pounds	93.42	7493
Barcelona	Pounds	112.60	6216
Basle	Pounds	92.64	7556
Bassano	Pounds	132.82	5270
Batavia	Catties	76.78	9117
Bengal	Seers	53.57	12066
Bergamo	Light pounds	139.	5032
——	Heavy pounds	55.64	12580
Bergen	Pounds	91.	7700
Berlin	Pounds	96.80	7231
Bern	Pounds	86.85	8060
Betelfagui	Maunds	49.04	14273
Bilboa	Light pounds	92.59	7560
——	Tron weight pounds	63.42	11037
Bologna	Pounds	125.31	5586
Bolsano	Pounds	90.61	7725
Bordeaux	Pounds	91.72	7632
Bremen	Pounds	90.93	7098
Brescia	Pounds	138.62	5050
Breslaw	Pounds	111.90	6255
Brunswick	Pounds	97.14	7206
Brussels	(See *Antwerp.*)		

TABLE II.—*Continued.*

Country.	Name of Weight.	W't of 100 lb. Avoird.	W't of a single lb. mark, &c. in English Grains.
Cairo	Rottoli	105.	6664
Calemberg	Pounds	93.19	7511
Calicut	Seyras	163.05	4293
Candia	Rottoli	85.91	8148
Cassel	Pounds	92.32	7501
Chamberry	Pounds	105.72	6621
China	Catties	75.45	9277
Civita Vecchia	Pounds	132.90	5267
Cologne	Pounds	97.	7216
Courland	Pounds	96.09	7285
Constantinople	Okas	35.55	19688
——	Lodras	80.86	8663
——	Chekies	142.22	4922
Corfu	Pounds	111.	6304
Corsica	Pounds	131.72	5315
Cracow	Pounds	112.	6250
Cremona	Pounds	138.33	5060
Cyprus	Rottoli	19.07	36708
Damascus	Rottoli	25.28	27690
Dantzic	Pounds	103.87	6791
Denmark	Pounds	90.80	7725
Deventer	Pounds	96.43	7259
Dresden	Pounds	97.14	7206
Dunkirk	Pounds	105.86	6612
Elbing	Pounds	106.73	6558
Embden	Pounds		
England	Avoird. lbs.	100.	7080
Erfurt	Pounds	96.08	7285
Ferrara	Pounds	133.67	5237
Finland	Pounds	133.56	5241
Frankfort	Pounds	97.02	7210
France	Marc pounds	92.64	7556
——	Kilogrammes	45.35	15436
Geneva	Heavy pounds	82.35	8502
——	Light pounds	98.82	7085
Genoa	Peso grosso Rottoli	92.86	7538
——	Peso sottile pounds	142.74	4904
Groningen	Pounds	92.69	7552
The Hague	(See *Amsterdam.*)		
Hamburgh	Pounds	93.63	7476
Hanover	Pounds	93.20	7511
Havre de Grace	Pounds	85.78	8160
Heidelburg	Pounds	89.89	7787
Hildesheim	(See *Brunswick.*)		
Holland	(See *Amsterdam.*)		
Holstein	Pounds	93.83	7460
Japan	Catties	76.92	9100
Kiel	Pounds	95.18	7354
Koningsberg	Pounds	119.27	5869
——	New, (See *Berlin.*)		
Leghorn	Pounds	133.56	5241
Leipsic	Common pounds	97.14	7206
——	Butcher's weight lb.	90.	7771
Liebau	Pounds	109.84	6373
Liege	Pounds	95.49	7330
Lindau	Heavy pounds	78.58	8908
——	Light pounds	98.23	7126
Lisbon	Pounds	98·80	7085
Lisle	Pounds	105.61	6628
London	(See *England.*)		
Lubec	Pounds	93.83	7460
Lucca	Pounds	135.59	5163
Lucern	Pounds	94.	7447
Luneburg	(See *Hanover.*)		
Lyons	Poids de tab. pound	105.87	6612
——	Light weight pound	98.81	7084
Madeira	Pounds	104.10	6724
Madras	Dis	32.	21875
——	Pollonis	12 80	574
Madrid	(See *Spain.*)		
Magdeburg	(See *Berlin.*)	107.82	6492

TABLE II.—*Continued.*

Country.	Name of Weight.	W't of 100 lb Avoird.	W't of a single lb. mark, &c. in English Grains.
Majorca	Rottolos	74.07	9450
Malabar	(See *Calicut.*)		
Malacca	Catties		
Malta	Pounds	143.20	4888
Manheim	Pounds	91.65	7638
Mantua	Pounds	143.70	4871
Marseilles	Pounds	111.63	6271
Mecca	Rottoli	98.	7144
Mecklenburg	Pounds	93.86	7458
Memel	Pounds	109.82	6374
Milan	Peso Grosso pounds	60.39	11592
——	Peso Sottile pounds	140.90	4968
Minorca	Heavy pounds	37.88	18480
——	Light pound	113.63	6160
Mocha	Maunds	33.33	21000
——	Viakias	13333.5	525
Modena	Pounds	141.93	4932
Monaco	Pounds	136.87	5114
Montpellier	Com. weight pounds	113.58	6163
Morea	Silk weight pounds	113.50	6167
——	Pounds	90.79	7710
——	Okas	37.83	18503
Munich	Pounds	80.87	8656
Munster	Pounds	95.31	7344
Naples	Rottoli	50.19	13750
——	Libre	141.41	4950
Narva	Pounds	96.84	7228
Negropont	Rottoli	84.72	8261
Neufchatel	Poids de Marc (See *France.*)		
——	Poids de fer pounds	87.18	8029
Nice	Pounds	146.25	4786
Nimeguen	Pounds	91.65	7638
Nordlingen	Pounds	92.53	7565
Norway	(See *Bergen.*)		
Novi	(See *Genoa.*)		
Nuremberg	Pounds	88.94	7870
Oldenburg	(See *Hamburgh.*)		
Oran	Rotollos	90.	7775
Ormuz	Seyras	149.73	4675
Osnaburg	Pounds	91.80	7625
Ostend	(See *Antwerp.*)		
Paderborn	(See *Munster.*)		
Padua	Peso Sottile pounds	133.33	5250
	Peso grosso (see *Venice.*)		
Parma	Pounds	139.33	5024
Passau	Pounds	94.41	7414
Pegu	Vis	30.	23333
Pernau	Pounds	108.86	6430
Perugia	Pounds	130.	5382
Pillau	Pounds	113.56	6164
Pisa	Pounds	139.22	5028
Pondicherry	Vis	30.88	22668
Portugal	(See *Lisbon.*)		
Prague	Pounds	88.16	7940
Presburg	(See *Vienna.*)		
Ragusa	Pounds	124.84	5607
Ratisbon	Pounds	79.81	8791
Ravenna	Pounds	151.42	4628
Reggio	Pounds	137.48	5692
Revel	Pounds	105.52	6646
Riga	Pounds	108.46	6454
Rome	Pounds	133.69	5236
Rostock	Pounds	88.75	7887
Rotterdam	Pounds	91.80	7625
——	Lt. weight pounds	96.39	7262
Rouen	Poids de Vicomte	87.40	8009
——	Pounds		
Russia	Pounds	110.86	6314
Saltzburg	Pounds	81.	8642
St. Gall	Heavy Pounds	77.58	9022

TABLE II.—*Continued.*

Country.	Name of Weight.	W't of 100 lb. Avoird.	W't of a single lb. mark, &c. in English Grains.
——	Light pounds	97.55	7176
St. Remo	(See *Genoa.*)		
St. Sebastian	Pounds	92.64	7556
Sardinia	Pounds	114.29	6125
Sayde	Rottoli of Damascus	24.35	28746
——	Ditto of Acre	20.75	33740
Scotland ——	Pounds Dutch weight	92.11	7600
Siam	Catties	38.76	18060
Sicily	Rottoli grossi	51.93	13475
——	Ditto sottili	57.14	12250
——	Libre	142.85	4900
Sienna	Pound	101.38	6904
Smyrna	Okes	36.51	19172
——	Rottoli	81.13	8628
Spain	Castilian weight lb.	98.40	7114
Stade	Pounds	95.46	7333
Stettin	(See *Berlin.*)		
Stralsund	Pounds	93.83	7460
Strasburg	Pounds	96.34	7266
——	Or like *France.*		
Sumatara	Catties	35.56	19683
Surat	Seers	107.14	6533
Surinam	(See *Amsterdam.*)		
Sweden ——	Victualie weight Pounds	106.67	6562
—— ——	Miner's weight Marks	120.68	5800
—— ——	Landstall weight Marks	126.70	5525
—— ——	Stapelstall weight Marks	133.33	5250
Tonquin	Pounds	94.27	7425
Teneriffe	Pounds	98.77	7087
Tetuan	Rottoli	63.96	10944
Toulon	(See *Marseilles.*)		
Trieste	(See *Venice* and *Vienna.*)		
Tripoli (in Syria)	Okes	37.45	18691
Tripoli (in Africa)	Rottoli	89.28	7840
Tunis	Do.	90.09	7770
Turin	Pounds	122.93	5694
Ulm	Pounds	96.77	7234
Valencia	Heavy pounds	84.72	8262
——	Light pounds	127.08	5508
Venice	Peso grosso pounds	94.74	7389
——	Peso sottili pounds	150.	4667
Verona	Peso grosso pounds	91.19	7676
——	Peso sottili pounds	136.35	5134
Vicenza	Peso grosso lbs.	92.75	7547
——	Peso sottile lbs.	133.33	5250
Vienna	Pounds	81.	8638
Warsaw	Old pounds	120.	5832
——	New Polish lbs.	112.25	6236
Wismar	Pounds	93.76	7466
Wurtzburg	Pounds	95.08	7362
Yvica	Pounds	97.97	7145
Zante	(See *Venice.*)		
Zelle	(See *Hanover.*)		
Ziricsee	Pounds	103 94	6735
Zurich	Heavy pounds	86.03	8136
——	Light pounds	96.78	7233
Zwoll	Pounds	94·10	7439

WEIMAR, SAXE, an independent grand duchy in the interior of Germany, contains about 1450 square miles. It is divided into two provinces, that of Weimar and that of Eisenach.

	Extent in square miles.	Population.
Weimar	970	135,000
Eisenach	480	66,000
	1450	201,000

In the province of Weimar, the district of Illmenau is the most mountainous; but the soil is generally fertile, yielding sufficient corn for the inhabitants, while the pasture on the hills support numerous flocks of sheep. In the beautiful valley of Jena, the vine ripens its fruit, but elsewhere the climate is cold. The province of Eisenach is more mountainous, and its wealth consists in its pastures, forests, and mines. A little hemp and flax are raised, but very little corn. The revenue of the Grand Duke is about £150,000, and the military 1000. The constitution is representative.

WEIMAR, the capitol of the above Grand Duchy, is situated on the north bank of the river, which winds along the side of the town, through a pleasant valley. The town is plainly built, and has an antique appearance. The principal building is the Grand Duke's palace, which is a large castle situated to the east of the town, and encircled with a fine park, which extends along the banks of the river, and is open to the public. The other public buildings are the house of the states, a workhouse, an hospital, a theatre, two Lutheran churches, one of which contains the mausoleum of the reigning family, and is adorned with several valuable paintings. There are many useful and well managed institutions in this town. Among these are a classical gymnasium, a university for schoolmasters, and an academy of painting, sculpture, and drawing. The public library contains 100,000 volumes, and in the palace there is a valuable library, a museum, a cabinet of medals, and a gallery of paintings. There is here a very extensive institution for publishing maps, globes, geographical and other works. In the vicinity is the Belvidere, another residence of the reigning family, situated on a beautiful eminence to the south. Population 8000. East Long. 11° 21′. North Lat. 50° 59′ 12″.

See Klebe's *Historisch statistiche nachrichten von der berubmten Residenzstadt Weimar*. Elberfeld 1800, and Russel's *Travels in Germany*.

WELD. See FRANCE, *Index*.

WELLINGTON, a large market town of England in Somersetshire, is situated on the south side of the river Tone, on the grand western canal. It consists of four streets, of which the high street is wide and spacious. The houses, which are of brick, are in general good. The principal public building is the church, which is a handsome Gothic building with an elegant embattled tower at its west end, decorated with 12 beautiful pinnacles, and furnished with a clock and bells. The church is 110 feet long, and 51 broad, and the tower 100 feet high. The church contains some fine monuments, among which is the magnificent tomb of Sir J. Popham. The principal manufactures are serges, druggets, and pottery on an extensive scale. Population of the parish in 1821, 837 houses, 842 families, 207 ditto engaged in agriculture, 524 in manufactures, and total population 4170.

WELLINGTON, a market town of England in Shropshire, is situated near a branch of the Shropshire Canal, and consists of several narrow irregular streets. The town, however, has been lately much improved, and contains many good houses. The church is a handsome building, erected in 1790, and supported by cast iron columns. Coal, iron and limestone abound in the vicinity. The furnaces for melting iron are supposed to be the largest in England. The manufactures of the town consist of nails, and other articles of hardware. At Admaston, in the vicinity, are two mineral springs. Population of the parish in 1821, houses 1700, families 1871, those engaged in agriculture 185, ditto in trade 1465. Total number of inhabitants 8390.

WELLS, a city of England in Somersetshire, is situated at the south foot of the Mendip Hills, near the source of the river Axe. It consists of several parallel streets, intersected by others of a smaller size, which are neatly built and well paved. The principal building is the cathedral which stands at the west end of the town, and is built in the form of the cross, its length being 380 feet from east to west, and 180 from north to south. It contains nine chapels, one of which, dedicated to the Virgin Mary, has gothic windows of stained glass and of great beauty. It is 52 feet long and 35 broad. In the centre of the transept is a quadrangular tower 178 feet high. The west part is flanked with two smaller towers 125 feet high, in one of which are six large bells. A short way south of the cathedral is the bishop's palace, a fine and venerable pile of building. Its walls, flanked by bastions at the angles, enclose an area of seven acres. The deanery is a handsome building, and the houses for the prebendaries and vicars are good. The other public edifices are St. Cuthbert's church, with its lofty and well proportioned tower, the market house and the town-hall, beneath which is Bishop Bubwith's hospital. There is a charity school here for 20 boys and 20 girls, and some well endowed almshouses. The principal manufactures are those of knit stockings and lace. About two miles north-west of Wells is the remarkable cavern of *Wookey Hole*, about 600 feet long. Its entrance is a small aperture near the base of a perpendicular rock about 200 feet high, and it contains in some places wide and lofty apartments. The population of Wells, consisting of the parish of St. Andrews, St. Cuthbert in and St. Cuthbert out, was in 1821, houses 1058, families 1275, families engaged in agriculture 500, do. in trade 524, total number of inhabitants 5888.

WELLS, WILLIAM CHARLES, an eminent physician and natural philosopher, was born at Charlestown in South Carolina in May 1757, his parents having arrived there from Scotland a few years before. He was educated at the grammar school of Dumfries in Scotland and in 1770 he went to the university of Edinburgh. In 1771 he returned to Charlestown, where he began the study of medicine. In 1775 he returned to London, and between 1775 and 1778 he pursued his medical studies at Edinburgh. In 1779 he went to Holland as surgeon to a Scotch regiment, and in 1780 he took his degree of M.D. at Edinburgh, the subject of his Thesis being on "Cold." In 1782, Dr. Wells returned to Charlestown, and while he was there he was at the same time a volunteer officer, a printer, a bookseller, a merchant, and on one occasion a judge advocate. In December 1782, when the king's troops evacuated Charlestown, he went to St. Augustine in East Florida, where he edited the first weekly newspaper that had appeared in that province. Here he became a captain of a volunteer corps, and manager of a company of officers who had agreed to act plays for the relief of the loyal refugees from Carolina and Georgia. In 1784 he went to London, and after paying a three months visit to Paris in 1785, he settled in London as a physician. In 1788 he was admitted a licentiate of the royal college of physicians, and in 1793, a fellow of the royal society, to whose transactions he communicated several interesting papers.

In the year 1812, Dr. Wells began a series of experiments on dew, and after they were completed, he published, in August 1815, his Essay on Dew, which contains some important discoveries upon which his reputation as a philosopher chiefly rests. In 1816 the royal society of London adjudged to him the Rumford medals for these discoveries, of which we have already given a full account in our Article METEOROLOGY, Vol. XIII. p. 185-188.

In 1814, Dr. Wells was admitted a fellow of the royal society of Edinburgh. The ardour with which he had pursued his experiments on dew, and the exposure of himself to the open air which they required, injured his health, which he never again recovered. He died on the 18th September 1817, in the 64th year of his age.

The only work of any importance besides his Essay on Dew, is his "Essay upon Single Vision with Two Eyes," Lond. 1792, a work of great merit, but not free from considerable errors. His other writings consist of papers of temporary interest in the Philosophical Transactions and in the Periodical Journals. See the Gentlemen's Magazine for Nov. 1817, for a more minute account of his life.

WELSHPOOL, a market town of Wales, in

Montgomeryshire. It is situated about a mile from the Severn, and consists chiefly of a long and spacious street. It is neat and clean. The church and the county-hall, which is a brick building, are the chief edifices. The population of Welshpool parish in 1821 was 3460. See MONTGOMERYSHIRE, Vol. XIV. p. 725.

WERNER, ABRAHAM GOTTLIEB, a celebrated minerologist, was born at Wehrau on the Queiss, in Upper Lusatia, on the 25th September 1750. His father, who was director of a forge, gave him different minerals as playthings, and thus accustomed him in early life to recognise them by their more prominent properties. From the school at Bunsleur he went to the Mineralogical Academy at Freyburg, and from thence to Leipsic, where he studied natural history and jurisprudence. Here he published, at the age of 24, his treatise on the external characters of mineralogy, a pamphlet of only a few sheets. In 1775 he was appointed professor of mineralogy, and inspector of the mineralogical cabinet at Freyberg. In 1780 he published the first part of a translation of Cronstedt's mineralogy, and in his notes on this work he gave the first sketches of his mineralogical system.

In 1791 Werner published his new theory of the formation of metallic veins, which was translated into English by Anderson, and into French by d'Abuisson. In 1792 he was appointed counsellor of the mines in Saxony. His cabinet of minerals, consisting of 100,000 specimens, was sold for 40,000 crowns.

The distresses of his sovereign and his country seem to have prayed upon his mind, and produced a complication of diseases, and having gone to Dresden in the expectation of some mitigation of his suffering, he was taken ill, and died in the arms of his sister on the 30th June 1817, in the 67th year of his age.

Werner had undoubtedly the merit of extending the study of mineralogy, but his reputation never rose above that of a popular lecturer, who derives his fame from the gratitude and admiration of his pupils. No mineralogist ever enjoyed a higher degree of contemporary applause, and its echo will doubtless be heard in another generation; but when mineralogy has been purified from its barbarous technology and its empirical methods, and when it has attained that dignity and perfection which it must soon receive from the labours of the natural philosopher, the crystallographer and the chemist; we shall in vain look among its facts, or among its generalizations, for any thing that has been contributed either by Werner or his pupils. See Baron Cuvier's *Historical Eloge of Werner*, in the *Memoirs of the Institute of France.*

WERNERITE, &c. MINERALOGY *Index*.

WESLEY, JOHN, one of the founders of methodism, was born at Epworth in Lincolnshire in June 1703, and he died on the 2d March 1791. For an account of his labours see our article METHODISTS, Vol. XI. p. 190-191.

WEST, BENJAMIN, the youngest son of John and Sarah West, was born in the township of Springfield, in the county of Delaware, then a part of Chester county, Pennsylvania, on the 10th of October 1733.

The West family emigrated from England with William Penn on his second visit to Pennsylvania about the year 1699. They had joined in religious fellowship with the society of Friends about twenty years previous to their emigration; and it is probable that their inducements to leave their native land was the hope of enjoying, under the mild and paternal administration of William Penn, that perfect toleration in the enjoyment and exercise of their faith, which was denied them in the country of their birth. John West, the father of Benjamin, married Sarah, the daughter of Thomas Pearson, about the year 1714, by whom he had ten children. The farm on which the artist was born was originally settled by his maternal grandfather, and called Springfield, in consequence of a large spring of water which rose in the first field that was cleared for cultivation. From this circumstance the township afterwards received the name of Springfield.

West exhibited, even in his childhood, the germs of those great talents for painting, which secured for him, in the maturity of manhood, the patronage of princes, and the admiration of the lovers of the fine-arts. It is a question which has been a fruitful theme for controversy among speculative philosophers, whether the particular bent and direction of genius was the work of nature, or the result of habit and early associations. Without presuming to pronounce a decisive judgment on this point, it may be observed that the early history of the youthful artist who is the subject of this notice, must be admitted at least to strengthen the argument in favour of native talent for particular pursuits. His first essay at the art in which he afterwards became so celebrated, appears to have been made in his seventh year. Being left in charge of a child who was sleeping in the cradle, while his mother and a near relation took a walk in the garden to gather flowers, which were then in full bloom, his attention was particularly arrested by the sweet smile of the sleeping infant. By his own account, his imagination was awakened, and he felt an emotion such as he had never before experienced. He instinctively seized some paper, pens and ink, which he observed on a table, and endeavoured to delineate her portrait. When his mother returned, he manifested some anxiety lest she should be offended at what he had done. But after viewing for sometime this first specimen of the genius of her son, she was so far from being displeased, that she showed the pleasure she felt by carresses. This encouraged him so much that he immediately offered to draw the likeness of the flowers which she held in her hand. When the drawing of the sleeping infant was shown to his father, he acknowledged it to be a good likeness, and was not less pleased than his mother had been at this early indication of talent in his little son. When it is considered that he was then not seven years old, that he had never seen a picture or drawing of any kind, nor heard of the art of portrait painting, we cannot withhold our admiration of the strength of that instinct of nature which prompted him, at so early a period, to imitate the powers that excited sensations of pleasure in his mind.

From this time he seems to have possessed a consciousness of his powers. He felt that he could imitate whatever gratified his eye or pleased his fancy. His first essays were necessarily rude and imperfect. His materials were but illy suited to his genius. The first colours he used were charcoal and chalk, mixed with the juice of berries; and his first imitation of a pencil was made of the fur of a cat, drawn tightly through a goose quill. With such implements of his art as these, when about nine years old, he drew on a sheet of paper the portraits of a neighbouring family, in which the delineation of each individual was sufficiently accurate to be immediately recognised by his father when the picture was first shown to him. When about twelve years old he drew a portrait of himself, with his hair hanging loosely about his shoulders.

When advanced in life he was very desirous of obtaining this portrait, as a specimen of his juvenile productions, and frequently wrote to his relations in Pennsylvania to procure it for him if possible. But it could not be found.

When a little school-boy, he drew a ship in the sand, which took the attention, and excited the admiration of his school-fellows, and drew them from their play to examine it. One of them seemed displeased at this interruption to their amusements, and reluctantly followed the other boys, who were assembled round the young artist to view this evidence of his skill. When this boy at length condescended to look at the picture of the ship in the sand, West asked him what he thought of it. "I think," answered the boy "that time and chance happen to all, and you'll be a great man yet:" which prediction he confirmed by an oath. It appears that this incident, trifling as it may seem, made a lasting impression on the mind of West. For in his letters to his friends in Pennsylvania, he frequently made inquiries after this boy, and reminded them of his prediction.

One of his early productions was the treaty of William Penn with the Indians, under the great elm tree in Kensington. This painting was for many years in the possession of his brother; but he lent it to an artist of Philadelphia, who never returned it, and it cannot now be found. The loss of this painting is deeply regretted by his friends and relations, on account of the interesting character of the subject, the merits of the design, and the skill displayed in the execution.

He was first taught how to mix red and yellow colours by a party of Indians who visited his father's house at Springfield. To these his brother added blue, by giving him a piece of indigo. But the greatest stimulus and encouragement was given to his genius when very young, by a present of a box of paints, some pencils, several pieces of canvass, and a number of engravings, from a relation of the family who resided in Philadelphia. The attention of this relative had been attracted by some specimens which he had seen of the young artist's skill, when on a visit to his father's house; and perceiving the embarrassments under which he laboured for want of suitable materials on which to exercise his native talent, he sent him the presents above mentioned. These presents filled him with delight and enthusiasm. For several successive days he spent his time in a retired room in the garret, where he spread the canvass on the floor, and imitated the figures in the engravings. In this delightful employment he forgot the school hours, and joining the family at meal times, he concealed from his parents the manner in which he spent his time. At length the school-master sent to learn the cause of his absence from school. This led to a discovery of the nature of his employments and the cause of his absence. His mother had observed him retiring to the garret, and on examination she found him at work at his painting. Her displeasure at his absenting himself from school was changed into admiration, when she came to view his performance. "He had not condescended to copy a single engraving; but had selected the most striking features from a number, and by combining them with wonderful taste and accuracy, had composed a picture as complete in the arrangement of the several parts, and colouring of the whole, as the most skilful artist could have painted, under the direction of a finished master." "Sixty-seven years afterwards," says his biographer Galt, "Mr. West had the gratification of seeing this piece in the same room with his sublime painting of 'Christ Rejected,' on which occasion he declared that there were inventive strokes of art in his first juvenile essay, which, with all the knowledge and experience he afterwards acquired, he had never been able to surpass."

When about fourteen years old, at the solicitation of his uncle John Clarkson, he was placed under the tuition of Dr. Smith, Provost of the college of Philadelphia. Under the patronage of his uncle, he was instructed in classical literature, and had every facility afforded him for the cultivation of his talent for painting. Dr. Smith, perceiving the bent of his genius, gave such a direction to his instructions as would improve his taste, and give him a perfect knowledge of the great masters of Greece and Rome. "He did not impose upon him those grammatical exercises of language which are usually required from young students of the classics, but directed his attention to those incidents which were likely to interest his fancy, and furnish him at some future time, with subjects for the pencil."* He continued to prosecute his studies advantageously, until about sixteen years of age. About this time it became an object of solicitude with his father that the occupation of his life should be finally determined. And here we have to record one of the most remarkable and interesting incidents in his life.

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* Galt.

The bent of West's mind was well known to his connexions and friends, and the indulgence given by his father to his inclinations, was regarded rather unfavourably by the members of the religious society to which he belonged. He was anxious, therefore, in determining the future course of his son, to receive the countenance and approbation of his friends. For this purpose a meeting of the members of his own society was called at the meeting-house at Springfield, to deliberate on the subject, and to advise the father upon this interesting occasion. At this meeting, after a long debate and consultation, it was finally concluded that as God had evidently bestowed upon the youth extraordinary genius for the art of painting, it would be presumption in them to attempt to counteract the designs of Omniscience, or to say that these peculiar talents ought not to be cultivated. In the strong inclinations of the young man's mind, they saw an impulse of the divine hand, pointing to his proper destination. This conclusion, so liberal, and at the same time so rational, is alike honourable to the youth who was the object of it, and to the assembled elders of a sect whose prejudices and peculiar views were opposed to the occupation to which West seemed destined.

After this first meeting, another was appointed to be held at his father's house, at which young West was desired to be present. Here the previous solemn conclusion of the first assembly was confirmed, and the youth received the encouragement and the blessing of the venerable heads of his own society, of both sexes, who had met on his account, and who, in obedience to what they believed to be the designs of Providence, gave their sanction to a pursuit which was not in accordance with the strictness of their peculiar tenets. It was cause of gratitude to West during life, and was a source of his most pleasing recollections, even when encouraged by the patronage of princes, that he had engaged in his favourite pursuit with the approbation of his friends, and the blessings of the society to which his family belonged.

After it had been determined by his relations and friends, that Benjamin West should pursue the bent of his inclinations, and cultivate his favourite art, he returned to Philadelphia, and resided with his relation John Clarkson, where his studies were directed by Dr. Smith. He continued his studies and the practice of his art in Philadelphia, New York, Lancaster and some other places, until the year 1759, when it was resolved that he should visit Europe, and study the masterly performances of Rome and the other cities of Italy. He embarked at Philadelphia, on the 10th of October 1759, and after a pleasant passage, during which the vessel touched at Gibraltar, and several ports on the coast of Spain, he landed at Leghorn, whence he proceeded to Rome, where he was immediately introduced by letters from his friends in Philadelphia and Leghorn, to some of the most distinguished characters in that emporium of the fine arts. He early obtained an introduction, by means of an English gentleman residing at Rome, to Mengs, a famous Italian artist, who was at that time in the height of his popularity. The circumstance of an American, and a quaker, coming to Rome to study the fine arts, was thought so singular and extraordinary, that Mengs expressed much surprise at the information. He requested West to show him a specimen of his skill. This request was readily complied with, and a portrait of the English gentlemen who had procured his introduction to Mengs, and with whom West was on terms of intimacy, was soon produced, which received the applause of the best judges in Rome, as well as of the artist himself; and West was at once acknowledged as second only in his art to the first painter then at Rome. "Mengs himself, on seeing the picture, expressed his opinion in terms that did honour to his liberality, and gave the artist advice which he never forgot, nor remembered without gratitude. He told him the portrait showed that he had no occasion to learn to paint at Rome. 'You have already, sir,' said he, 'the mechanical part of your art: what I would therefore recommend to you, is, to see and examine every thing deserving attention here, and after making a few drawings of about half a dozen of the best statues, go to Florence, and observe what has been done by art in the collections there; then proceed to Bologne, and study the works of Carracca; afterwards visit Parma, and examine attentively, the pictures of Correggio; and then go to Venice, and view the productions of the great masters there. When you have made this tour, come back to Rome, and paint a historical composition, to be exhibited to the Roman public, and the opinion which will then be formed of your talents, should determine the line of our profession you ought to pursue.' This judicious advice, West found to accord so well with his own reflections and principles, that he resolved to follow it with care and attention."*

West spent about four years in Italy, in visiting those places recommended to him by Mengs, and in studying the works of the great masters of Italy and Rome. From Italy he went to France, where he remained no longer than was necessary to enable him to visit the works of the French artists, and the museums and royal collections at Paris. He was convinced by this visit to Paris, that the French did not possess the same tastê for the fine arts as the Italians. He reached London in the month of August 1763. Here a new era opens in the life of this extraordinary man. He had left his native country to visit the schools of the artists in Italy, and to become acquainted with the works of the great masters of antiquity. That concurrence of prosperous and fortunate events which seemed always to accompany him through life, had made his journey through Italy delightful beyond his most sanguine expectations, and gained him the esteem and confidence of some of the first characters in Europe. From the society of plain, unassuming Pennsylvania quakers, the son of a farmer, born in the country, and reared in the simple habits of the followers of William Penn, he was now about to become the companion of courtiers, and to obtain the patronage and the confidence of princes. But in every situation he retained the same grave unassuming traits of character.

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* Galt.

He was introduced to court at an early period after his arrival. He drew a portrait of the queen Charlotte, with which the king, George III., was so well pleased, that it secured his countenance and friendship to West ever after. He was desirous of returning to America, but his patron and friend, the king, would not consent. He had been engaged to a young lady of Philadelphia, before his departure for Italy, with whom he wished to fulfil his engagement. But it was concluded to send for her to England; and in 1765 his father accompanied her across the Atlantic, and they were married soon after her arrival. Her maiden name was Sewal, and she was a lady of great merit. In London she was called the Philadelphia beauty.

The productions of Benjamin West's pencil are so numerous, that we shall not attempt to name them. For fifty-five years he was continually adding to the list. His most celebrated pieces were, the "*Death of General Wolfe*," "*Death on the pale horse*," "*Christ Rejected*," and "*Christ healing the sick*," the last of which was presented by him to the Pennsylvania Hospital. For "*Christ Rejected*," £10,000 sterling were offered and refused. On the death of Sir Joshua Reynolds, in 1791, West was elected president of the Royal Academy, which office he held till his death.

West's mind seemed to be exempt from the spoil of years. To the latest period of his life, he was engaged in his favourite pursuit, and suffered no visible decay of his power, either of design or execution. Till within a short time before his death, his mind was occupied in devising plans for future works which he had in contemplation.

In 1817 he lost the companion with whom he had lived for more than half a century, and in the month of March 1820, this extraordinary man breathed his last. He was buried in St. Paul's Cathedral, London. He left two sons, Rembrandt and Benjamin.

Benjamin West was as remarkable for his calmness and cheerfulness as for his genius. His habits of simplicity, which were acquired in youth, seemed natural to him, and he preserved them through life. He was mild and dignified, combining gravity and cheerfulness in his manners. The circumstances of his fortune seemed to correspond in a remarkable degree with the placidity of his temper. In his passage through life, he encountered no storms, and scarcely a counter current or an adverse wind ever ruffled the tranquil serenity of his progress. His prosperity, and the honours received from nobles and princes, did not change the mild and placid character of the simple Pennsylvania quaker. His mind was absorbed in the profession of his choice, and was unmoved by the applause of the world or the smiles of the great. In short, his character, from youth to old age, is without a speck or a blemish, and the evidences of his genius which he has left behind him, will enrol his name among the favoured few whom nature has gifted with extraordinary powers. E. LEWIS.

WEST CHESTER, a post-town of Chester county, Pennsylvania, on the dividing ridge between the waters of Chester and Brandywine creeks, two miles east of the latter stream, and five miles south of the Philadelphia and Lancaster turnpike; 23 miles nearly due west from Philadelphia, and by post road 115 miles northeast from Washington city. The seat of justice of the county was removed from Old Chester to this town in 1786, prior to the division of the county, and it is probably to this circumstance it owes its existence as a borough, into which it was incorporated in the year 1799. The chartered limits, under the name of "the burgesses and inhabitants of the borough of West Chester," embrace a space of about one and a quarter miles square; it is governed by a a chief burgess, second burgess, and five assistants, elected annually by the inhabitants.

The original plan of the town consisted of four contiguous squares, with two principal streets, crossing in the centre; in 1829 several streets were opened and new squares formed on the southwestern side of the town; the side walks were paved with brick in 1823, and the two principal streets were Macadamized in 1829 and 1830.

The public buildings are a court house, prison and offices for clerks, register and recorder of the county; and a market house which was erected in 1831, and is situated in that part of the town recently improved; it is 100 feet long, and is well supplied with provisions.

There are four places of worship, viz. two friend's meeting houses, one Roman catholic chapel, and one methodist episcopal church, besides which a Presbyterian church, 45 feet front by 75 feet deep, is now being erected. There is also a library, academy, cabinet of natural sciences, and atheneum, the three latter incorporated; and there was a boarding school for young ladies established in 1830, in which are taught all the useful branches of an English education. The buildings erected specially for the purpose are pleasantly situated on a gentle elevation, immediately south of the village; and are calculated for the accommodation of about 60 young ladies; it is under the superintendence of a gentleman, who from long experience is eminently qualified for the task he has undertaken; it has received a liberal patronage and promises extensive usefulness. There is also in the town a number of minor literary establishments, and six weekly newspapers are published.

The Bank of Chester county established in this borough was incorporated in 1814, with a capital of 450,000 dollars, only 112,140 of which has been called in. It is one of the best conducted banking institutions in the state, has been extensively useful in the neighbourhood, and productive of large profit to the stockholders.

There is a daily line of stages between West

Chester and Philadelphia, beside which two other lines from Baltimore and Lancaster pass through the borough, thus affording a constant medium of intercourse with the city.

A rail way was commenced in May 1831 to connect with the great Pennsylvania rail road about 18½ miles westward of where the latter crosses the Schuylkill. It is a single track road with the necessary turns out and passing places. The bed, however, is graded and prepared of sufficient width for two tracks; it is now nearly completed, the main line being finished about the 1st August of the present year, 1832. It is nine miles in length, and the aggregate cost to the company, including all collateral expenses, will be about 90,000 dollars. By this connection with the Pennsylvania road, the borough will enjoy all the facilities which that important improvement is calculated to produce, in connection with the trade of the Delaware, Schuylkill, and Susquehanna rivers.

By the census of 1820 the population of the borough was 552, in 1830 it had increased to 1252, and in January last was about 1500; the number of dwellings at this period were 234, of which about 200 are in the village, and the residue on the adjacent farms; but a considerable addition to this number has recently been made, among which may be particularly noticed an extensive hotel near the new market house, and another large building in the same neighbourhood, erected for a hall of meeting by the society of Odd Fellows.

For particular information relative to the statistics of West Chester, the reader is referred to the Pennsylvania Register for January 1832.

WESTCHESTER, county of New York, bounded S.E. by Long Island Sound; S. by Haerlem strait or river, separating it from New York county; S.W. by Hudson river, separating it from Berger county New Jersey; N.W. again by Hudson river, separating it from Rockland, county of New York; N. by Putnam county; and E. by Fairfield county of Connecticut. Length from south to north 42 miles; mean breadth 11, and area 462 square miles. Extending in Lat. from 40° 49′ to 41° 24′ N. and in Long. from 3° to 3° 12′ E. from W. C.

The southern part is a narrow ridge, with a rapid declivity eastward to Long Island Sound, and westward to the Hudson. To the northward the county widens, and the slope generally S.S.W. towards the Hudson. The surface very uneven, and soil in its natural state rather sterile, but rendered productive by art. By the census of 1830 the county contained an aggregate population of 36,456, yielding a distributive population of nearly 79 to the square mile.

Bedford township, containing the village of the same name, and seat of justice, jointly with White Plains, contained, in 1830, 2750 inhabitants. It is 44 miles N. from New York city. There are 33 post offices in this county, two of which are at Bedford and Whiteplains. DARBY.

WESTMEATH, an inland county of Ireland in the province of Leinster, is bounded on the west by Cavan, on the east by Meath, on the south by King's county, and on the west by Roscommon and Longford, from the former of which it is separated by the Shannon. It is about 25 miles long from W. to S., and 24 from E. to W., and contains 562 English square miles, and 378,880 English acres. It is divided into 12 baronies and 62 parishes, of which 21 have churches, all of them being in the diocese of Meath.

The general aspect of this county is diversified with large lakes, woods, unproductive bogs, and rich grazing lands. The surface rises into small hills, cultivated to the top, or covered with wood.

The principal rivers are the Shannon, Inny, and the Brosna. The Shannon extends into a fine lake called Lough Ree, or the Royal Lake. The Inny, rising in Cavan, enters Lough Sheilin on the borders of Westmeath, and after passing through Loughs Derveragh and Iron, falls into Lough Ree. The principal lakes are Lough Ree, full of wooded islands, Loughs Shelin, Leign, Iron, Derveragh, Hoyle or Owell, and Ennel, some of which are encircled with well cultivated land, and others with low wooded hills. They are well stored with pike, perch, bream, tench, trout, and fine eels. The trout are red and sometimes of 10 lb. weight, and, according to Mr. Young, a child with a packthread and crooked pin may catch in an hour as many perch as will support a family for a day.

The soil is generally light, though in some places deep and rich. Most of it lies on limestone, and yields very fine pasture, supporting a great many fine large horned cattle and long woolled sheep. Tillage is carried on upon a limited scale, but still to such an extent as to supply the home consumption, and allow the farmers to contribute to the exportation of oats from Drogheda. Beside the usual crops, flax, hemp, and rape are raised; and clover and turnips to a small extent.

The principal towns are Athlone (see ATHLONE), which is partly situated in Roscommon, Mullingar the county town, Mool-grenogner, Kilbeggan, and a few other small places. Mullingar is a large and well built town, with extensive barracks, and carries on a considerable trade, and the rest are places of little note.

The county sends two members to parliament, and Athlone one. The landholders are chiefly protestants, but the rest of the population is catholic. Population in 1791, 69,000, and in 1821, 128,000.

WESTMINSTER. See LONDON.

WESTMORELAND, a northern county of England, is bounded on the E. by Yorkshire and Durham, on the N. and N.W. by Durham and Cumberland, and on the S.W. by Lancashire, a narrow strip of which separates it from the sea. It is of a very irregular shape, its greatest length being about 40, and its greatest breadth 35 miles. It contains 763 square statute miles, and 488,320 English statute acres.

The county is divided into two baronies, namely, that of Kendal and that of Westmoreland, and into four wards, viz. those of Kendal, and Kirkby Lonsdale, in the barony of Kendal, and the East and West Wards, in the barony of Westmoreland. The rental of land in this county is £221,556, added to £7606, the amount of tithe, the annual value of a square mile being £299 lower than that of any other county of England.

The general aspect of the county presents a great extent of bleak and barren fells and moors, and groups of lofty, naked and picturesque mountains. Three-fourths of the county nearly consists of uncultivated land. The mountain valleys, which form the beds of the rivers, are moderately fertile, and yield good crops of oats, and in some instances of wheat and barley. Agricultural improvement has advanced rapidly in this county. The clover and turnip husbandry has made great progress, and through a large portion of the bottom of Westmoreland, and in the parishes of Heversham, Burton, and Kirkby Lonsdale, considerable quantities of wheat are annually raised. Many commons have been enclosed, and immense tracts drained. The cattle of this county are of the long-horned breed, and attain a large size. The mountainous districts support large flocks of sheep, which yield a coarse wool, but the breed has been lately much improved by crossing. Great numbers of geese are fed on the moors, and along with hams are exported in great quantities.

The principal mountains in Westmoreland are Crossfell, the highest of the chain on its eastern boundary, and 3000 feet above the sea. Helvellyn is 3100 feet high, Bowfell and Rydalehead, each 3090, and the High Street is 2736 feet high. This last mountain derives its name from a broad green road along its summit, where the shepherds have annual horse races on the 10th of July.

The principal rivers of the county are the Eden, the Lane, the Kent, the Eamont, the Winster, and the Lowther, none of which are navigable. They contain abundance of fish, and exhibit much picturesque scenery. The tide enters the mouth of the Winster, Kent, and Betha in Moricambe bay, but the county rises so rapidly, and the channels of the rivers become so stony, that they do not admit even the use of boats.

The principal lakes of Westmoreland are Windermere, Ulles-water, Grassmere, Rydale-water, Elter-water, Hause-water, Red Tarn and Small-water, and Skeggles-water. An account of Windermere has already been given in our article England, Vol. VIII, p. 518-519, and of Ulles-water in our articles Cumberland and England, Vol. VIII. p. 517-518. Grassmere is about four miles in circuit, with a small green island in its centre. Its margin is hollowed into rude bays with bold rocky eminences. A low promontory projecting into the water contains a whole village with the parish church rising in the midst of it: and hanging enclosures, corn-fields and green meadows with their trees, hedges and cattle, fill up the small space from the edge of the water. Rydale-water is about a mile long, and contains two picturesque islands covered with wood. Hause-water is about three miles long, and about one-third of a mile broad, and is surrounded with steep, bold, and craggy rocks. Its trout and char are highly esteemed.

The mineral productions of Westmoreland are lead, copper, coal, limestone, blue slate, marble, gypsum and freestone. The best coal is found in the confines of the county in Stanemore forest. An inferior slaty coal is found in several places, but it is used only for burning lime. Marble has been wrought near Kendal on both sides of the Kent.

The manufactures consists chiefly of silk and worsted waistcoat pieces, knit worsted stockings, flannels, cotton goods, gun-powder and tanned leather. The exports are principally coarse woollen cloths, stockings, slates, tanned hides, gunpowder, hoops, charcoal, hams, cattle, sheep, and wool. See Kendal.

Westmoreland sends two members to parliament, and the borough of Appleby other two.

Westmoreland contains one borough, viz. Appleby, and seven market towns, Ambleside, Brough, Burton, Kendal, Kirkby Lonsdale, Kirkby Stephen, and Orton.

		Population in 1821.
Appleby	Borough and township	324
Ambleside	Chapelry	838
Brough	Township	940
Burton	Township	673
Kendal	Town	8984
Kirkby Lonsdale	Town	1643
Kirby Stephen	Township	1312
Orton	Township	1527

Vestiges of two Roman roads are still visible, and the remains of several Roman camps.

The population of the county in 1821 was

Houses	9,243
Families	10,438
Ditto engaged in agriculture	5,096
trade	3,801
Males	25,513
Females	25,846
Total population in 1821	51,359

See the *Beauties of England and Wales*, and the Articles Appleby and Kendal.

WESTPHALIA. See Prussia.

WEXFORD, a maritime county in the south-east of Ireland, is bounded on the east and south by the sea, on the west by Waterford, Kilkenny, and Carlow, and on the north by Wicklow. It is about 56 miles long from north to south, and 32 from east to west, and contains 934 English square miles, and 597,760 English acres.

The county is divided into 8 baronies and 142 parishes, all of which but two are in the diocese of Ferns. The two islands called Salters belong to the county.

This county is mountainous in its north, north-west and west confines. It contains much coarse land, and stiff clay soil, which, from the want of limestone, it is difficult to improve. The best part of the county is the baronies of Bargie and Forth on the east, where the land is less elevated, and where the soil is sufficiently light to produce excellent crops of barley. Beans are successfully cultivated, and also clover and turnips. Potatoes are planted in drills, and lime and marl, though expensive, are much used as manure. Whole fields are kept under furze as in Cork and Waterford for fuel. Although there are no rich grazing farms, yet there are numerous dairies, which are ill-managed. The cows and the sheep are of an inferior kind.

The rivers are the Slaney and the Barrow. The former crosses the county from Newton-Barry to Wexford, and receiving the Barrow from the north, exhibits on its fine wooded banks much beautiful and picturesque scenery. It is navigable to Enniscorthy near the middle of the county. By means of the Barrow which divides the county from Kilkenny on the west, large vessels can reach the town of New Ross, situated near the junction of the Barrow and Nore.

The principal towns are Wexford, the county town, described in a separate article, Enniscorthy on the Slaney, New Ross, and Gorey, and the pleasant village of Newton-Barry. Enniscorthy was once celebrated for its iron works, of which some still exist. The cotton manufacture is now carried on here, and a great deal of coarse woollen cloth is made. There is a fine old castle here in tolerable repair. The town was nearly destroyed during the rebellion in 1798. New Ross, on the Barrow, is well fitted for becoming a place of commercial importance. The buildings are said to be numerous and elegant, and the population rapidly increasing. Vessels of large size can unload at the quay, and it is one of the principal ports for the exportation of wool.

The county sends two members to parliament, and Wexford and New Ross send one each.

The population in 1821 was 169,304. According to Wakefield, the Catholics were to the Protestants as 10 to 1, and most of the personal property and part of the landed was in the hands of the former. See Frazer's *Statistical Survey of Wexford.*

WEXFORD, a seaport town of Ireland, situated at the mouth of the river Slaney. The town is irregularly built, and the streets narrow, but it contains some handsome buildings. The church, situated in the principal street, is an elegant modern structure. The market and court-house are built with much taste, and the barracks erected on the site of the old castle, command an extensive view. The great ornament of the town is the wooden bridge thrown across an arm of the sea 2100 feet wide, where it was found impracticable to erect a bridge of stone. This bridge is the favourite promenade. Wexford was once a place of great strength, and some remains of its ancient thick walls still exist. The harbour is formed by two tongues of land between which there is an entrance half a mile wide, which was formerly defended by Fort Margaret and Fort Rosslane built at the end of each isthmus. The harbour, though spacious, is shallow, and its mouth is choaked with a bar which prevents vessels drawing more than 12 feet water from reaching the town. A good deal of woollen cloth is manufactured in the town and neighbourhood, and the chief trade consists in the exportation of barley, malt, beer, beef, hides, butter and tallow. The town was built by the Danes, who called it Wessford.

WEYMOUTH, a seaport and burgh town of England, in Dorsetshire, long celebrated as a fashionable watering place, is situated near the mouth of the little river Wey, and communicates, by means of a handsome stone bridge, with Melcombe-Regis. The streets are chiefly built on the sea shore. The most fashionable are Gloucester row, Chesterfield place, York buildings, Charlotte row, Clarence buildings, St. Alban's row, Bellevue and the Esplanade. The church is a low edifice consisting of three aisles, ornamented with a fine altar piece and the last supper, executed and presented by Sir James Thornhill to the town. To the east of the church there are some buildings, the remains of a Dominician Priory. The chapel of the Priory is now used as a malt house. The Quakers and the Independents have meeting houses in the town. A handsome set of assembly rooms were erected in 1772. This building, which comprehends a hotel and other appendages, is 600 feet long, and 250 wide, and cost £6000. The royal assembly room is lofty and spacious. The theatre is neat and elegant. The principal library, which is nearly in the centre of the Esplanade, is handsomely fitted up. There is on the quay a convenient salt water bath. The trade of Weymouth is small, being chiefly to Newfoundland and the Mediterranean. Shipbuilding is carried on to some extent. There are barracks for cavalry in the vicinity; and the harbour is defended by a handsome battery of 21 small guns, and by the new fort, the north fort, and the dock fort, each mounted with 3 heavy guns. The Esplanade is the favourite promenade. It is about half a mile long and 30 feet wide. The bay, containing the public bathing place, makes a semicircular sweep of nearly two miles, and is protected from winds by the surrounding hills. About a mile from the town are the ruins of Sandisfort castle, situated on a lofty cliff.

Melcombe-Regis has a good market-place and town hall. It was incorporated as a borough with Weymouth by Elizabeth. They send two members to parliament who are elected by 200 voters.

The population of the two places in 1821, was 1090 houses, 1471 families, 8 do. engaged in agriculture, and 870 in trade. Total population 6622. See the *Beauties of England and Wales*, vol. iv. p. 351, &c.

WHALE. See CETOLOGY, Vol. V. p. 564.

WHALE FISHERY.

The Whale Fishery, or Greenland Fishery, as it has been called, has been long carried on by the different nations of Europe. The Biscayans seem to have been the first people who prosecuted the capture of whales, but the first authenticated notice of a fishing for whales is the account of the voyage of Ohthere, the Norwegian, by Alfred the Great. This voyage seems to have been undertaken about 890, some time after the discovery of Greenland. He stated to the king that the best whales where hunted on his own land, and that their length was 48 and 50 ells.

About four or five centuries later, the whale fishery, as a general occupation, was carried on by the French, Spaniards, Flemings, and probably the English; and during the 16th century, the Biscayans had not only established a fishery for fin whales on their own coasts, but had pursued it to the shores of Iceland, and subsequently to those of Greenland and Newfoundland.

The earliest voyage made by the English, in pursuit of the whale, was performed in 1594. Several ships sailed for Cape Breton, and the Grace of Bristol brought home 800 whale fins from the bay of St. George, where two large Biscayan fishermen had been wrecked three years before.

There can be no doubt that the discovery and the first prosecution of the whale fishery on the coast of Spitzbergen, belong to the English, who preceded the Dutch by four years. The merchants of Hull had, in 1598, begun to fish for whales on the coast of Iceland, and at the North Cape, and after the rediscovery of Spitzbergen by Hudson, in 1607, they were among the earliest adventurers to that distant fishery.

In 1611 the Russian Company fitted out two vessels, one of 160, and another of 60 tons, with six Biscayans, expert in killing whales, and furnished with the necessary apparatus. The ships were unfortunately lost, but the crew and boats, and part of the cargo, were saved by a Hull ship then at Spitzbergen.

The advantages of the whale fishery being now recognised, the Dutch, Danes, and Hamburghers, embarked in the adventure, and though the English endeavoured to prohibit them from fishing in the Spitzbergen seas, yet they persisted in carrying on the fishery, and discovered new bays to which the whales resorted in abundance. The monopoly of the Spitzbergen fishery was afterwards claimed by various nations; but these claims have long ago been set aside, and the antarctic seas are now open to the enterprize of all nations.

In 1613 the English Russia company received a monopoly of the whale fishery. The grant was renewed in 1635 by Charles I., but this branch of trade fell into decay, and notwithstanding various attempts to revive it, it sunk into absolute insignificance.

At this time the Dutch pursued it with renewed vigour, and between 1699 and 1708 they equipped 1652 ships, which caught 8537 whales, which produced 26,385,120 florins, of which 4,727,120 was clear profit.

In order to revive the whale fishery, the British government resolved in 1773 to grant a bounty of 20*s.* per ton on the burden of every ship that engaged in it. This was successively raised to 30 and 40*s.* per ton, and again reduced to 25 and 20*s.*, at which last rate it has continued since 1795. These measures had the effect of placing the whale fishery upon a permanent basis. The Scotch embarked eagerly in the speculation after the bounties were established, and have enjoyed their full share in this trade, as will be seen from the table of the state of the fisheries from 1750 to 1788.

View of the extent of the British Greenland and Davis' St
Whale Fisheries.

ENGLAND.						SCOTLAND.			
Year.	No. of ships employed.	Tonnage.	Bounties Paid.			Year.	No. of ships employed.	Tonnage.	Bounties
			L.	s.	d.				L.
1750	19	6,264	10,507	3	3	1750	1	333	666
1751	23	7,360	16,530	19	10	1751	6	1,933	3,866
1752	30	9,871	17,231	9	5	1752	10	3,137	6,274
1753	35	11,814	27,693	0	11	1753	14	4,294	8,589
1754	52	17,235	31,328	6	9	1754	15	4,680	9,361
1755	66	21,293	45,634	18	8	1755	16	4,964	9,299
1756	67	21,328	42,103	1	0	1756	16	4,964	9,315
1757	55	17,221	34,450	0	0	1757	15	4,530	8,567
1758	52	15,399	27,006	6	1	1758	15	4,499	8,271
1759	34	10,337	19,273	18	1	1759	15	4,479	8,959
1760	40	12,082	20,540	5	6	1760	14	4,238	8,477
1761	31	9,789	19,247	15	8	1761	14	4,238	8,477
1762	28	8,877	13,358	6	9	1762	14	4,238	8,045
1763	30	9,416	18,465	15	9	1763	10	3,109	5,649
1764	32	10,261	19,463	16	1	1764	10	3,140	6,281
1765	33	10,099	18,748	17	9	1765	8	2,559	5,119
1766	35	10,015	19,947	2	5	1766	9	2,797	5,595
1767	39	12,284	24,537	9	2	1767	9	2,797	5,595
1768	41	12,802	24,026	18	1	1768	9	2,797	5,595
1769	44	13,471	24,935	12	11	1769	9	2,797	5,595
1770	50	14,775	29,240	18	11	1770	9	2,797	5,595
1771	50	14,700	27,891	7	6	1771	9	2,797	5,595
1772	50	15,378	29,089	12	11	1772	9	2,797	5,595
1773	55	16,712	31,231	13	9	1773	10	3,016	6,033
1774	65	19,770	37,863	2	6	1774	9	2,773	5,547
1775	96	29,131	54,978	13	10	1775	9	2,773	4,503
1776	91	27,047	52,028	3	1	1776	7	2,251	4,503
1777	77	21,917	30,942	5	3	1777	7	2,251	2,280
1778	71	20,291	29,280	8	4	1778	5	1,587	1,923
1779	59	16,907	25,294	16	1	1779	3	957	1,435
1780	52	14,900	21,584	12	4	1780	4	1,282	1,923
1781	34	9,859	14,379	12	4	1781	5	1,459	2,189
1782	38	11,122	21,156	2	2	1782	6	1,764	2,190
1783	47	14,268	27,017	12	6	1783	4	1,095	2,190
1784	89	27,224	53,162	2	1	1784	7	2,047	4,094
1785	136	41,741	84,122	6	2	1785	13	3,865	7,729
1786	162	49,426	101,996	9	6	1786	23	6,997	13,993
1787	219	64,280	95,038	17	1	1787	31	9,057	13,454
1788	222	63,399	93,768	0	9	1788	31	8,910	13,230
	2449	740,065	1,335,098	1	2		430	130,998	242,837

The following table shows the number of ships fitted out each year from England and Scotland:

	1810	1811	1812	1813	1814	1815	1816	1817	1818
Eng.,	75	76	83	94	97	98	97	100	104
Scot.,	22	22	27	43	46	49	49	50	53

The number of vessels sent out from each of the different ports of England and Scotland during the above period of nine years, including repeated voyages, was as follows:

Berwick,	16	Newcastle,	43	Kirkaldy,	7
Grimsby,	13	Whitby,	80	Kirkwall,	6
Hull,	481	Aberdeen,	98	Leith,	79
Liverpool,	17	Banff,	8	Montrose	25
London,	161	Dundee,	68	Peterhead,	62
Lynn,	13	Greenock,	8		

"In the four years," says Mr. Scoresby, "ending with 1817, 392 vessels sailed from England to these northern fisheries, the amount of whose cargoes was 3348 whales, besides seals, narwhales, bears and sea-horses; and the produce 35,824 tons of oil, and about 1806 tons of whalebone, together with a quantity of skins. The average quantity of oil produced per ship on each voyage, was 91.4 tons, and about 4 tons 12 cwt. of whalebone. From Scotland there sailed in the course of the same period of four years, 194 vessels to the whale fisheries, the amount of whose cargoes was 1682 whales, &c., and the produce 18,684 tons of oil, and about 891 tons of whalebone, besides skins. The average cargo procured per ship on each voyage, produced 96.3 tons of oil, and about 4 tons 12 cwt. of whalebone; being the same quantity of whalebone, but 4.9 tons of oil more than the average procured by the English fleet during the same time. It therefore appears, that of late years, the people of Scotland have sent out their full proportion of ships on the fisheries; and with a degree of success which has been equal, if not superior, to that of the English fishers.

The British whale fishery of 1814 was uncommonly prosperous, especially at Greenland; 76 ships on this fishery having procured 1437 whales, besides seals, &c. the produce of which in oil only, was 12,132 tons, being an average of $18\frac{9}{10}$ fish, or 159.6 tons of oil per ship! The average fishery of Davis' Straits the same season, was about one-third less per ship. The gross value of the freights of the British Greenland and Davis' Straits fleets (bounties included), estimating the oil at £32 per ton, which was about the average price, and the whalebone at £80 per ton, exceeds in this one year £700,000.

Though the profits to the merchants on this occasion were singularly great, yet, on the average of the four years, ending with 1817, we find the cargoes brought from Greenland and Davis' Straits were only 93 tons of oil, and 4 tons 12 cwt. of whalebone per ship, value about £3700. This, though a degree of success which would have been considered as very great fifty years ago, is now, on account of the extraordinary increase which has taken place in the expenses of a whale ship, but barely sufficient to afford an encouraging profit to the adventurers. But when we consider, that while the general profit reaped from the trade was only moderate, some individuals and concerns have been almost invariably successful; it is clear, therefore, that some others must have been considerable losers by this speculation.

In a national view, however, the benefit has been very different. In the five years ending with 1818, about 68,940 tons of oil, and 3420 tons of whalebone, of British fishing, have been imported into England and Scotland. If we calculate the oil at £36 10*s*. per ton, which was about the average price, and the whalebone at £90, and add to the amount £10,000, for the probable value of the skins and other articles,—the gross value of goods imported into Britain from Greenland and Davis' Straits in five years, free of first cost, will appear to have been near three millions sterling.

The greatest cargo ever brought into Great Britain in one vessel from the whale-fishery, was procured near Spitzbergen, by Captain Souter in the Resolution of Peterhead, in the year 1814. It consisted of 44 whales, which produced 299 tons of oil, value, reckoned at £32 per ton, the average price that year, £9568; if to this we add the value of the whalebone and the bounty, the gross freight of this ship will appear to have been near £11,000. Other ships, however, with less cargoes, have made still greater freights, particularly in 1813, when oil sold for near £60 per ton. In this year, the John of Greenock, commanded by my father, made above £11,000 freight; and the cargo of the Esk of Whitby, commanded by myself, sold for near the same sum. The Augusta of Hull, Captain Beadland, procured a still greater cargo; and the Lady Jane of Newcastle, Captain Holmes, which brought home a larger cargo from the fishery that season than any other vessel, realized, I believe, the greatest profit ever made by one vessel in any one season, since the northern whale-fisheries were practised."

The following very interesting table will show the relative success of the ships fitted out at different ports during the four years ending with 1817.

British Ports engaged in the Whale Fishery.	Number of Ships.			Amount of Cargoes obtained.			Average Cargo per Ship each Year.		
	Equipped in four Years.	Average per Year.	Lost in four Years.	Number of Whales.	Tons of Oil.	Tons of Whalebone.	Number of Whales.	Tons of Oil.	Tons of Whalebone.
London	77	19¼	2	775	6,631	346	10.1	86.1	4.5
Hull	229	57¼	3	1785	20,891	1064	7.8	91.2	4.6
Whitby	39	9¾	0	433	4,181	201	11.1	107.2	5.2
Newcastle	23	5¾	1	164	2,295	108	7.1	99.8	4.7
Other English Ports	24	6	1	191	1,826	87	8.0	76.1	3.6
Total from England	392	98	7	3348	35,824	1806	8.5	91.4	4.6
Aberdeen	55	13¾	0	427	4,618	225	7.8	84.0	4.1
Leith	40	10	0	278	3,756	170	7.0	93.9	4.2
Peterhead	33	8¼	0	402	3,815	187	12.2	115.6	5.7
Dundee	32	8	0	248	3,496	159	7.7	109.2	5.0
Montrose	15	3¾	0	127	1,169	62	8.5	78.0	4.1
Other Ports in Scotland	19	4¾	1	200	1,830	88	10.5	96.3	4.6
Total from Scotland	194	48½	1	1682	18,684	891	8.7	96.3	4.6
Total from Britain	586	146½	8	5030	54,508	2697	8.6	93.0	4.6

The ships intended for the Greenland and Davis' Straits fishery should be from 300 to 400 tons burden. They should be strengthened with an additional series of planks, and fortified by the application of timber and iron plates to the exterior, and a great number of timbers and stauncheons to the interior. To preserve the stem from the ice, it is provided with a *false* or *ice*-stem, and on the sides of this are placed the ice-knees, or angular blocks of wood, filling up the concavity formed by the stem and fore planks. The stem is also defended by *ice-plates* of half inch iron.

Each ship has generally six or seven boats, *carver-built*, they vary from 23 to 28 feet in length, and are capable of carrying six or seven men, and seven or eight hundred weight of whale lines, and various other materials.

The crew of the whale ships generally consist of forty or fifty men, including several classes of officers or harpooners, boat-steerers, carpenters, coopers, &c. together with foremast-men, landsmen, and apprentices. Every individual, from the master to the boys, has, besides his monthly pay, a gratuity for every size fish caught during the voyage, or a certain sum for every ton of oil produced from the cargo.

The weapons generally used in capturing the whale are the harpoon and the lance. The harpoon is made of iron, and is three feet long. It consists of three conjoined parts, the *socket*, the *shank*, and the *mouth*, the mouth includes the *barbs*, within each of which there is another small barb like the beard of a fish hook, in a reverse position. The lance is a spear of iron, six feet long. It consists of a hollow socket six inches long, swelling from half an inch, the diameter of the shank, to nearly two inches, into which a four-feet fir handle is fitted,—a shank five feet long, and a mouth of steel, very thin and sharp, seven or eight inches long, and two or two and a-half broad. A harpoon gun is sometimes used for throwing the harpoon to a greater distance than it can be done by the hand. In its most improved form it is made of a swivel, with a barrel of wrought iron about twenty-five inches long, three inches diameter, and one and a-half inch internal bore. It is fired by two locks which act together.

Every boat is furnished with two harpoons, six or eight lances, and from five to seven oars.

When a whale is seen on the surface of the water, unconscious of being observed, the harpooner runs directly upon it, and buries his harpoon in its back; but, when the boat is at a little distance, and the whale is preparing to dive, the harpoon is thrown from the hand, or discharged from a gun, and will be effective, in the former case, at the distance of eight to ten yards, and in the latter at the distance of thirty yards or more. The wounded animal makes a convulsive effort to escape. The boat is subjected to the most violent blows from its head or its fins, but chiefly from its ponderous tail, which sometimes sweeps the air with such fury that both boat and men are exposed to imminent destruction. Harpooners have been struck dead with a single blow of a whale's tail. One of the crew of the John of Greenland had his foot separated from his leg, by slipping it through a coil of line in the act of running out; and a harpooner of the Henrietta of Whitby, having made a whale dart downward by a powerful stroke of his lance, the line caught him round the body, and he was almost cut asunder, dragged overboard, and never afterwards seen.

When the harpooner of the ship Resolution, commanded by Captain Scoresby, had struck a whale, it gave the boat such a violent blow with its tail, that the boatsteerer was thrown to some distance, and a fresh blow projected the harpooner and line-manager in a similar manner.

" A remarkable instance, says Mr. Scoresby, of the power which the whale possesses in its tail, was exhibited within my own observation, in the year 1807. On the 29th of May, a whale was harpooned by an officer belonging to the Resolution. It descended a considerable depth, and, on its reappearance, evinced an uncommon degree of irritation. It made such a display with its fins and tail, that few of the crew were hardy enough to approach it. The captain (my father) observing their timidity, called a boat, and himself struck a second harpoon. Another boat immediately followed, and unfortunately advanced too far. The tail was again reared into the air, in a terrific attitude,—the impending blow was evident,—the harpooner, who was directly underneath, leaped overboard,—and the next moment the threatened stroke was impressed on the centre of the boat, which buried it in the water. Happily no one was injured. The harpooner who leaped overboard escaped certain death by the act,—the tail having struck the very spot on which he stood. The effects of the blow were astonishing. The keel was broken,—the gunwales, and every plank, excepting two, were cut through—and it was evident that the boat would have been completely divided, had not the tail struck directly upon a coil of lines. The boat was rendered useless.

Instances of disasters of this kind, occasioned by blows from the whale, could be adduced in great numbers,—cases of boats being destroyed by a single stroke of the tail are not unknown,—instances of boats having been stove or upset, and their crews wholly or in part drowned, are not unfrequent,—and several cases of whales having made a regular attack upon every boat which came near them, dashed some in pieces, and killed or drowned some of the people in them, have occurred within a few years, even under my own observation.

The Dutch ship Gort-Moolen, commanded by Cornelius Gerard Ouwekaas, with a cargo of seven fish, was anchored in Greenland in the year 1660. The captain, perceiving a whale a-head of his ship, beckoned his attendants, and threw himself into a boat. He was the first to approach the whale; and was fortunate enough to harpoon it before the arrival of the second boat, which was on the advance. Jacques Vienkes, who had the direction of it, joined his captain immediately afterwards, and prepared to make a second attack on the fish, when it should remount again to the surface. At the moment of its ascension, the boat of Vienkes happening unfortunately to be perpendicular above it, was so suddenly and forcibly lifted up by a stroke of the head of the whale, that it was dashed to pieces before the harpooner could discharge his weapon. Vienkes flew along with the pieces of the boat, and fell upon the back of the animal. This intrepid seaman, who still retained his weapon in his grasp, harpooned the whale on which he stood, and, by means of the harpoon and the line, which he never abandoned, he steadied himself firmly upon the fish, notwithstanding his hazardous situation, and regardless of a considerable wound that he received in his leg in his fall, along with the fragments of the boat. All the efforts of the other boats to approach the whale, and deliver the harpooner, were futile. The captain, not seeing any other method of saving his unfortunate companion, who was in some way entangled with the line, called to him to cut it with his knife, and betake himself to swimming. Vienkes, embarrassed and disconcerted as he was, tried in vain to follow this counsel. His knife was in the pocket of his drawers; and, being unable to support himself with one hand, he could not get it out. The whale, meanwhile, continued advancing along the surface of the water with great rapidity, but fortunately never attempted to dive. While his comrades despaired of his life, the harpoon by which he held, at length disengaged itself from the body of the whale. Vienkes being then liberated, did not fail to take advantage of this circumstance; he cast himself into the sea, and, by swimming, endeavoured to regain the boats which continued the pursuit of the whale. When his shipmates perceived him struggling with the waves, they redoubled their exertions. They reached him just as his strength was exhausted, and had the happiness of rescuing this adventurous harpooner from his perilous situation.*

In one of my earliest voyages to the whale fishery I observed a circumstance which excited my highest astonishment. One of our harpooners had struck a whale, it dived, and all the assisting boats had collected round the fast-boat, before it arose to the surface. The first boat which approached it advanced incautiously upon it. It rose with unexpected violence beneath the boat, and projected it and all its crew to the height of some yards in the air. It fell on its side, upset, and cast all the men into the water. One man received a severe blow in his fall, and appeared to be dangerously injured; but soon after his arrival on board of the ship, he recovered from the effects of the accident. The rest of the boat's crew escaped without any hurt.

Captain Lyons of the Raith of Leith, while prosecuting the whale fishery on the Labrador coast, in the season of 1802, discovered a large whale at a short distance from the ship. Four boats were despatched in pursuit, and two of them succeeded in approaching it so closely together, that two harpoons were struck at the same moment. The fish descended a few fathoms in the direction of another of the boats, which was on the advance, rose accidentally beneath it, struck it with its head, and threw the boat, men and apparatus about fifteen feet into the air. It was inverted by the stroke, and fell into the water with its keel upwards. All the people were picked up alive by the fourth boat, which was just at hand, excepting one man, who having got entangled in the boat, fell beneath it, and was unfortunately drowned. The fish was soon afterwards killed."

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* I give this anecdote on the authority of the author of the Histoire de Peches, who translated it from the Dutch. Part of the story bears the mark of truth; but some of it, it must be acknowledged, borders on the marvellous.

The general practice of a whale that has been struck, is to escape from the boat by making under water, pursuing its course directly downward, and reappearing at a little distance. When the wounded whale disappears, a flag is elevated, and the watch in the ship gives the alarm by stamping on the deck, and calling out "a fall." At this sound the sleeping crew are roused, rush upon deck with their clothes in their hands, and crowd into the boats. The auxiliary boats take their stations about the place where the whale is expected to appear from the movements of the harpooner or "fast" boat.

The whale generally stays under water about thirty minutes, and sometimes fifty-six, but in shallow water it is said to have continued an hour and a half at the bottom after being struck. Immediately on its re-appearance, the harpooners of the auxiliary boats plunge their harpoons into its back. It frequently descends again after the second harpoon has struck it, and when it returns to the surface, lances are pierced through its body, and directed to its vitals. At last, exhausted with wounds and the loss of blood, which flows in copious streams, it discharges from its blow holes a mixture of blood along with the air and mucus which it usually breathes out, and at last jets of pure blood. The sea to a great distance around is dyed with its blood, and the ice, the boats, and the men are drenched with its gore. Its course is marked by a broad pellicle of the oil which has exuded from its wounds. The capture is sometimes preceded by a convulsive and energetic struggle, in which its tail, reared, whisked, and violently jerked in the air, resounds to the distance of miles. When dying, it turns on its back or side, and its death is announced with three loud huzzas.

Small whales sometimes exhaust themselves so completely in their descent downwards, that they are suffocated under water and are said to be drowned. In this case it is drawn up by the line.

The captured whale is then towed to the ship by all the boats in a line, which is done in the case of a large whale, and with six boats, at the rate of nearly a mile per hour. It is then taken to the larboard side of the ship, arranged and secured for the *flensing*. This is done by partly extending its body, and raising it by means of a pulley about a fourth or a fifth part out of the water. When the fish is thus lying with its belly upwards, the operation of flensing is performed. The harpooners, with their feet armed with spurs, to prevent them from slipping, descend upon the fish, and as directed by the *specksioneer*, they divide the fat into oblong pieces or slips by means of blubber spades. A speck or tackle is then fixed to each ship, and it is progressively flayed off as it is drawn upwards. The blubber, in pieces of from half a ton to a ton each, is received upon deck by the boat-steerers and line-managers. The former with strand knives divide it into portable cubical pieces containing nearly a solid foot of fat, while the latter, furnished with pick *haaks*, thrust it down a hole in the main hatches. It is then received by two men styled *kings*, who push it into a place called the flens-gut. The fat being removed from the belly, and also the right fin, the fish is turned on its side. The upper surface of fat is again removed together with the left fin, and a similar set of operations are carried on till the whole of the blubber, whale-bone and jaw-bone have been taken on board.

When the tackle is removed, the carcass or *kreng* as it is called, commonly sinks, but sometimes it is so swollen by the air produced by putrefaction, that it swims and rises three or four feet above the water. It thus becomes food for bears, sharks and various kinds of birds. The operation of *flensing* is accomplished in three or four hours when the fish affords 20 to 30 tons of blubber.

When the flens-gut is filled with blubber, or when the crew have leisure, the process of *making off* is carried on. This process consists in removing all the muscular part of the blubber, with such spongy or fibrous fat as is known to produce little oil. The blubber then cleared is stored in casks, and securely bunged up.

When the blubber is brought home, the oil is extracted from it by boiling in large copper boilers. The boiling is continued from one to three hours. In a ton or 252 gallons of blubber, there is from 50 to 65 gallons of refuse, the greater part of which is a watery fluid.

The following table shows the price of whale oil from 1800 to 1818, which, at an average, was about £34 15*s.* per ton.

	£		£		£
1800	35	1806	29	1812	35
1801	46	1807	21	1813	30
1802	31	1808	27	1814	32
1803	38	1809	36	1815	38
1804	31	1810	38	1816	28
1805	30	1811	31	1817	46
				1818	38

Whalebone is found in the mouth of the whale. It forms an apparatus like a filter for collecting the minute animals on which the whale feeds, the sea water running through. When taken from the whale, it consists of laminæ or plates connected by what is called the *gum*, and ranged along each side of the mouth. The laminæ are about 300 in number. The average length of the blade is 12 or 13 feet, though it is sometimes found 15 feet long. Its greatest breadth is 10 or 12 inches, and its greatest thickness about half an inch. The general appearance of the laminæ taken altogether, resembles the form and position of the roof of a house. At first the price of whalebone was £700 per ton, but it now fluctuates between £50 and £150.

For the information contained in the preceding article, we are indebted to Mr. Scoresby's admirable *Account of the Arctic Regions*, the second volume of which is devoted to a history and description of the northern whale fisheries. See also Noel's *Memoire sur l'Antiquité de la Peche de la Baleine par les Nations Europennes*, Paris 1795, 12mo. A brief account of the South Sea Whale Fishery will be found in our article ENGLAND, Vol. VIII, p. 605. See also POLAR REGIONS, Vol. XVI, p. 26.

WHEAT. See Agriculture, *Index*.

WHEEL and Axle. See Mechanics, Vol. XII. p. 605.

WHEELS, on the Teeth of. See Mechanics, Vol. XII. p. 650.

WHEELS, Water. See Hydrodynamics, Vol. X. p. 892.

WHEELS, Carriages. See Agriculture, Chap. VI. Vol. IV.

WHEELS of Carriages. See Coachmaking and Carriage. See also Ferguson's *Lectures on Mechanics*, vol. ii. Dr. Brewster's edition, and an admirable paper by James Walker, Esq. F.R.S.L. and E. published in Dr. Brewster's *Journal of Science*, Vol. I. p. 274.

WHIDAH, a kingdom of Africa on the Slave Coast, about ten miles long and seven broad. The whole kingdom has been compared to a great city divided by gardens, lawns, and groves instead of streets, the villages being scarcely a musket shot distant from each other, and so populous, that one village contains as many inhabitants as several entire kingdoms on the coast of Guinea. The year consists of a spring and autumn in constant succession, and as soon as the corn is cut, the fields are again sown. Whidah the capital is situated in East Long. 1° 24′ and 6° 25′ North Lat.

WHIRLING Table. See Ferguson's *Lectures on Mechanics*, vol. i. where it is minutely described. Atwood's machine for the same purpose is described in our article Mechanics, Vol. XII. p. 634.

WHIRLWIND. See Physical Geography, Vol. XV. p. 581.

WHITAKER, John, B.D. an eminent divine and antiquarian, was born in Manchester about 1735. He was educated at Oxford. His principal works are his *History of Manchester*, 4to. 1771, 1775, his *Genuine History of the Britons asserted*, 1771. Sermons on Death, Judgment, Heaven and Hell. His *Mary Queen of Scots vindicated*, 1787. His *Course of Hannibal over the Alps ascertained*, 2 vols. 8vo. 1795. The *Real Origin of Government*, 1795. The *Origin of Arianism disclosed*, London, 1791. The *Ancient Cathedral of Cornwall historically surveyed*, 2 vols. 1804, and a posthumous work entitled *The Life of St. Neot, the eldest of all the brothers of King Alfred*, Lond. 1709, 8vo.

Mr Whitaker died of a paralytic stroke on the 30th October 1808, at his rectory of Ruan-Lanyhorne, at the age of 73, leaving a wife and two daughters. See the *Gentleman's Magazine*, vol. lxxviii. p. 1037, and Nichol's *Literary Anecdotes of the Eighteenth Century*, vol. iii. p. 105.

WHITBY, a seaport town of England in the North Riding of Yorkshire, is situated on opposite declivities on both banks of the river Esk, which forms the harbour, and divides the town into two equal parts connected by a draw-bridge which allows ships of 500 tons to pass. The streets are in general narrow and steep, and the houses crowded together, but many of the houses are good, and those of the wealthier inhabitants large and elegant. Two or three new and handsome streets have been recently built on the west side of the town. The principal buildings are the town hall, a heavy edifice of the Tuscan order, a spacious poor's house, a dispensary, and a handsome school-house. The parish church stands on the verge of the cliff on the east side of the town, and is approached by 190 stone steps. There is a chapel of ease on the lower part of the town, and meeting-houses for the Methodists, who have two chapels, Presbyterians, Independents, Roman Catholics, and Quakers. There is also here a subscription library, and a commodious reading room. The Union Mill, belonging to 800 proprietors, is an imposing building on the west side of the town. On a high cliff on the east side of the town stand the ruins of the church of the old abbey of Whitby.

The principal manufactures of Whitby are canvas and kelp. Its commerce is very extensive, the inhabitants being largely concerned in the Greenland fishery, the coal trade, and the coasting and foreign trade. The quantity of alum rock, and the numerous alum works in the vicinity, alone support an extensive branch of trade. The harbour of Whitby, which is almost artificial, is formed by two stone piers, one of which extends 620 yards, and terminates in a rounded head with embrasures for a battery. In spring tides the depth of water is from 15 to 18 feet. The inner harbour above the bridge is secure and spacious. It is flanked with dockyards for building ships on both sides of the river, and has commodious dry docks. Shipbuilding is carried on to a great extent.

The vicinity of Whitby abounds with numerous fossil remains of great interest, an account of which will be found in Young's *History of Whitby*, 1816. Population in 1821 of the township; houses 1429, families 2131, ditto engaged in agriculture, 24, ditto in trade, 676. Total population, 8697.

WHITCHURCH, a market town of England, in Shropshire, is situated upon an eminence on the Wellington Canal, and consists of one principal street on the high road to Chester, intersected by some smaller ones. The church stands on the highest ground, and is a handsome stone building of the Tuscan order, with a square tower 108 feet high, and surmounted by battlements. It contains an elegant altar piece and two fine effigies, one of John Talbot, first Earl of Shrewsbury. There is here an excellent free school, a charity school, six alms-houses and meeting-houses for protestant dissenters. Population of the town about 2600. It is not entered in the census of 1821.

WHITE, county of Tennessee, bounded by Smith W., Jackson N.W. and N., Fentress E., Cumberland mountain separating it from Bledsoe S.E., and Caney Fork river separating it from Warren S. and S.W. Length 42, mean breadth 16, and area 672 square miles. Extending in latitute from 35° 40′ to 36° 17′, and in longitude from 8° 10′ to 8° 50′ W. from W. C.

The slope of this county is westward, and entirely drained by different branches of Caney Fork river. Chief town, Sparta. Population 8701 in 1820, but in that number were included a part of what is now contained in Fentress county. In 1830 the population amounted to 9967.

WHITEHAVEN, a seaport town of England in Cumberland, is situated at the mouth of the Poebeck on the Irish Sea. The town, which is built on a regular plan, is extremely handsome, not only for its spacious streets crossing at right angles, but from the houses being roofed with blue slate. The shops also are particularly elegant. The approach from the north is singular, from the heights being so much above the town, that the slated roofs only are visible till the traveller is near the entrance to the town, which is by a fine portico of red freestone, with a rich entablature bearing the Lowther arms. There are three chapels, St. James's, Trinity, and St. Nicholas. The interior of St. James's is particularly handsome. There are also several meeting-houses, a Roman Catholic chapel, a dispensary, a poor's house, a neat theatre, assembly rooms, a free school, and several charity schools. The castle, a residence of the Earl of Lonsdale, contains some fine paintings. The harbour of Whitehaven has been greatly improved, and accommodated to the activity of its trade. Light-houses are erected on the old and new quays, and the entrance to the harbour is defended by four batteries, containing 98 cannon, among which are twelve 42-pounders, and eighteen 36-pounders. The principal manufactures of Whitehaven are shipbuilding, for which there are six yards, sail-cloth, for which there are two establishments, and cordage, which is made in three roperies. The principal trade of Whitehaven is in coals, great quantities of which are sent to Ireland. The coal works are near the sea, and some are wrought even beneath the town, in consequence of which eighteen houses were destroyed in 1791, by the falling in of some of the old works. Some of the pits are 960 feet deep, and the working extends some miles beneath the sea. About 80,000 wagons of coals are supposed to be raised annually, each wagon weighing about 43 cwt. The coal staith, or magazine, on the west side of the town and near the harbour, contains 3000 wagon loads, and so perfect is the machinery employed, that from eight to twelve vessels, carrying from 100 to 120 tons, can be laden in one tide. Whitehaven carries on a trade to Africa, America, and the West Indies, and in 1822 it had 181 ships, with a tonnage of 24,220, or 145 tons each at an average. Two weekly papers are published here, and in summer a steam-boat plies between this port, Dumfries, and Liverpool. In 1821 the population of the town was 2117 houses, 2749 families, 45 ditto engaged in agriculture, 1324 in trade, &c. and total number of inhabitants 12,438. The population is said to have decreased in 1819 and 1820 from the decrease of trade.

WHITE RIVER, a large stream of the state of Missouri and territory of Arkansas, formed by the confluence of two streams, White river proper, and Black river. The following description is founded on the delineation on Tanner's Map U. S. White river proper rises in Washington county, Arkansas, about 30 miles northeastward from the junction of Arkansas and Candian rivers; flowing thence about 60 miles to the northeastward it enters the country of the Delaware Indians in the southwestern angle of Missouri. Curving to east and southeast 40 miles it enters the territory of Arkansas, within which it pursues a course of S.E. by E. by comparative distance 120 miles, joins Black river in Independence county. In its entire comparative course of 220 miles, White river receives few tributary streams of any considerable length or volume.

The northwestern confluent, Black river, rises in Wayne county, Missouri, interlocking sources with those of Merrimac and St. Francis, flowing thence, by a general southern course, but an elliptical curve to the E., about 100 miles, unites with an equal if not superior confluent, Current river. The latter rises also in Wayne county, Missouri, to the westward of the sources of Black river, and interlocking sources with the Merrimac and Gasconade rivers. The general course, curves, and length of Current river is remarkably similar to similar phenomena in Black river. The now navigable Black river, assuming a southwestern course 15 miles, receives at Davidsonville, seat of justice for Lawrence county, from the N.W. a large accumulation by the united streams of Eleven Points and Spring rivers. Below Davidsonville, Black river flows by comparative courses 45 miles, entering in that distance Independence county, and joining White river below the influx of Black river, is a little E. of S. by comparative courses 120 miles to its influx into the Mississippi, receiving in the latter distance Red river from the west, and Cache river from the east.

Taken as a whole, the valley of White river lies between those of Arkansas to the S.W., St. Francis to the E., the southern sources of Osage river to the N.W., and those of Merrimac to the N. The form of this fine valley approaches that of a triangle, 270 miles base; from the mouth of White river to the sources of Black river 170 miles perpendicular; area 22,950 square miles; extending in Lat. from 33° 56′ to 37° 40′, and in Long. from 13° 20′ to 17° 20′ W. from W. C. Rising in a mountainous region, the valley of White river exhibits every variety of soil, from the barren rock, and almost equally sterile prairie, to the rich, but annually submerged alluvion towards the Arkansas and Mississippi rivers. The White and Arkansas have their respective points of discharge within ten or twelve miles of each other, and are also connected by interlocking, and in seasons of high water, navigable streams, many miles above their mouths.

White river is navigable by both its great branches far above their junction. It is, however, an example of a stream greatly overrated, by estimating its length from the partial windings, in place of by the general comparative distances along the valleys. By that of White river proper, the valley is 340, and by Black river 280 miles long, pursuing the great curves of the rivers.

WHITE RIVER, Indiana, is the great southeastern branch of Wabash. It is formed by two branches, both rising about Lat. 40° N., and Long. W.C. 8° W. and near the W. boundary of the state of Ohio. Flowing by a general course S.W. about 70 miles, the two branches unite, and continuing below their junction 30 miles, joins the Wabash between Knox and Gibson counties, at Lat. 38° 27′ N. The valley of White river is a real curiosity in the hydrography of the United States. The extreme eastern sources of Croghan's Fork rise within one mile from the bank of Ohio river, opposite Gallatin county, Kentucky. A ridge of hills winds at no great distance from its banks, and nearly parallel to the Ohio, from the Great Miami to the Wabash. The northwestern streams of this ridge are discharged into either the White river or Wabash. The valley of White river is in form of an ellipsis, 180 miles long, with a mean width of 60, embracing an area of 16,800 square miles, and comprising about one third part of the state of Indiana. There are but few, if any, equal sections of the United States exceeding in natural advantages this tract. In fertility of soil and mildness of climate, it is really a desirable region. The streams without falls, are, except in seasons of drought, navigable almost to their sources. See article Wabash. DARBY.

WHITHORN, a royal burgh in Wigtonshire, is situated eleven miles south of the burgh of Wigton, between the Luce and Wigton bays, about two miles west of the latter. It consists of one street, extending south and north, its length being nearly half a mile. It was constituted a royal burgh by James IV. in 1511. The number of inhabitants is 1200. The isle of Whithorn, three miles south-east, is the port of this borough.

But Whithorn is particularly deserving of notice on account of its antiquity and celebrity. It is the site of the *Leucophibia* of Ptolemy. It is the place where the gospel was first preached in Scotland, and where the first place of Christian worship was erected. The person to whom these two events are owing is St. Ninian, who lived in the end of the 4th and beginning of the 5th century; and Leucophibia became *Candida Casa*, and since Whithorn, from the circumstance, as is supposed, of the church being built of white stone. The bishoprick which St. Ninian established, was at Whithorn; and Whithorn continued from that period till 1689 the see of the bishop of Candida Casa or Galloway. Ninian died in 452; but his memory was so much venerated, that many places both in Scotland and England were called by his name, and there is no saint in the Romish calendar whose tomb was so often visited. The kings of Scotland not only visited Ninian's shrine themselves, but encouraged others to do so, and granted protection to all strangers coming from England, Ireland, or the Isle of Man, in pilgrimage to Whithorn. James IV. performed this pilgrimage about twenty times,—once *on foot*, in consequence of the dangerous illness of the queen on the birth of their eldest son. She recovered; a result that was attributed to the miraculous influence of the saint: and when her health was re-established, she and her husband, as a matter of gratitude, performed the same pious journey in circumstances of great pomp and magnificence: seventeen horses were employed in transporting the queen's baggage; three in carrying the king's, and one in carrying the "chapel geir." James V. also paid visits to Ninian's tomb; and pilgrimages continued to be made thither till 1581, when they were prohibited by an Act of Parliament.

A priory for Premonstratensian monks was founded at Whithorn by Fergus, Lord of Galloway, about the middle of the 12th century. The church of the priory formed the cathedral church of the diocese; the prior and canons composed the chapter of the bishops; and the prior was vicar-general of the see during a vacancy. Many eminent men, such as archbishop Beaton and Archbishop Dunbar, were connected with this priory.

Of all these ancient buildings, there is now scarcely any remains. They had been allowed indeed to fall into ruins before the year 1684, when Symson wrote his account of Galloway. Some mouldering walls were demolished in 1823 to make way for a new place of worship. Some traces of walls may yet be discovered; large vaults are entire, and four arches of the original building still remain; they formed part of the parish church, which was dismantled in 1823. When digging the foundation of the new church, walls and vaults were discovered ten or twelve feet under the surface; and from an attentive examination, we are of opinion that the cathedral and priory were of greater extent and magnificence than is commonly imagined, covering at least two acres of ground.

See Chalmer's *Caledonia*, iii. § Wigtonshire; and Murray's *Literary History of Galloway*. (T. M.)

WHITLEY, county of Kentucky, bounded W. by Wayne county of the same state, N.W. by Rock Castle creek separating it from Pulaski, N. by Laurel, E. by Knox, and S. by Campbell county in Tennessee. Length from N. to S. 30, mean breadth 20, and area 600 square miles. Extending in Lat. from 36° 35′ to 37° 01′ N., and in Long. from 6° 48′ to 7° 14′ W. from W. C. The main volume of Cumberland river winds by a very circuitous channel over Whitley from S.E. to N.W. Chief town Whitley, C. H. By the post office list of 1831, there was a post office at Whitley, C. H. Population of 1830, 3807. DARBY.

WICK, a royal burgh of Scotland, in the county of Caithness, is situated at the embouchure of the little river Wick. The town is small, and the lanes confined, though the chief streets are of a moderate size. The harbour, which was formerly only the estuary of the river, has been improved by new piers and quays, at an expense of about £12,000. The town has in consequence been much improved, and many new houses erected on the south side of the river. Wick is the county town of Caithness, and along with Kirkwall, Dornoch, Dingwall and Tain, sends a member to parliament. The population of the town is above 1000, and that of the town and parish 6713.

WICKLOW, a maritime county of Ireland. It is bounded by the sea on the east, by Dublin county on the north, by Kildare, Dublin and Carlow on the west, and by Wexford on the south. It is about 40 English miles long and 33 broad, and contains 781 square miles, or about 500,000 English acres. It contains 58 parishes, of which 49 are in the bishoprick of Dublin, 6 in the diocese of Loughlin, and 3 in that of Ferns. The county is divided into 6 baronies and half baronies.

A great part of Wicklow is occupied with rocky mountains and bogs. In the N. and W. the mountains are bold and rugged, but in the east they are separated by fine wooded and romantic glens, such as those of Dargle, the Downs, the vale of Immalee, and Glendalloch. The central mountains consist of granite; and argillaceous schistus composes the lower hills. On the north is the remarkable chasm in a ridge of granite called the Scalp.

The minerals of Wicklow are gold, lead, and copper. Native gold has been found on the N.E. side of the mountains, Croughan Kenshela, in a stream which falls into the Ovoco. In 1796 £10,000 worth was found in pieces, one of which weighed 9, another 18, and a third 27 ounces. Government then explored the mines, but no veins were found, and the works were abandoned. Lead has been wrought at Glenmaher and Glendalloch, at the latter of which places there were in 1809 three smelting houses, and about 18000 cwt. of bar iron were make weekly. Copper has been wrought to a considerable extent at Cronebane and Ballymurtagh. The works at Cronebane produced in 1809, 3000 tons of ore at a cost of £8000. The works are now discontinued. Oxide of tin was found in the same stream in which gold occurred.

Wicklow has no river navigable within its limits. The Liffey rises in the N.W. of the county. The Ovoco runs into the sea at Arklow, the Fartrey does the same at Wicklow, and the Slaney rises in the S.W. of the county. Five of the streams produce fine waterfalls, the principal of which is at Powerscourt, 360 feet high. The chief lakes are Lough Bray, Lough Tay, Lough Dan, and the loughs of the seven churches.

The climate of Wicklow is remarkably fine, especially on the east coast. The myrtle grows in such profusion as to be used for stable brooms, and grapes ripen out of doors. The principal crops are wheat, barley, oats, and potatoes. Summer fallow being little known, the wheat follows the potatoe crops, and sometimes it is taken after white crops or upon the lea. The barley comes after potatoes or turnips. The crops are uncommonly abundant, though the soil is of a light quality. Dung, marl, and limestone gravel, are the chief manure. Scotch agricultural implements are now in general use.

Most of the improved breeds of cattle have been introduced. The dairies, which are numerous, are employed chiefly in feeding veal for the Dublin market. In the north early lambs are fattened to a considerable extent. The mountains of Wicklow afford good pasturage for sheep. The number of breeding ewes is about 20,000. The South Down are common, and many of the native flocks have been crossed with them. Merinos have also been introduced.

The principal manufactures of Wicklow are woollen and cotton goods. Besides the coarse woollens for common use, flannel is manufactured to a great extent. From 5000 to 7000 pieces were sold annually before 1808 at the flannel sale at Rathdrum. The cotton manufacture was then carried on with much spirit at Stratford-upon-Slaney. The linen manufacture has always been inconsiderable.

The principal towns, &c. are Wicklow, the county town, Baltinglas, Blessington, and Carysfort, which were formerly burghs. The villages are Rathdrum, Bray, Arklow, Stratford-upon-Slaney. Wicklow is boldly situated on the declivity of a lofty mountain. The church, which has a high square tower, is pleasantly situated on a lofty eminence. The jail, the court-house, and the market-house, are good modern edifices; and about a mile to the S.E. of the town are two light-houses. In 1816 Arklow employed from 100 to 150 boats in the herring-fishery, which has sometimes produced about £25,000 annually.

The population in 1790 was 58,000, and in 1821, 115,162, the Catholics being to the Protestants as 10 to 1. See Fraser's *General View of the Agriculture of the County of Wicklow*, 1801, Radcliffe's *Report of the Agriculture and Live Stock of the County of Wicklow*, 1812, and Mr. Griffith's *Report of Dr. Fellows, on the Mineralogy of the neighbourhood of Dublin.*

WIGAN, a town of England, in Lancashire, is situated on the small river Douglas, near its source, and on the Liverpool canal. The town, though irregular, is neat, and contains many handsome houses. The parish church consists of a nave, chancel and side aisles, and contains some good monuments. There is also a chapel, five meeting houses for dissenters, and two Roman Catholic chapels. The other buildings are a town-hall, a liberally endowed free-school, a blue coat school for boys, a dispensary, and a commodious workhouse. At the north end of the town stands the monument erected in 1679 by Mr. Rigby to the memory of Sir Thomas Tyldesley. The manufactures consist of home made linens, checks, fustians, calicoes, and other cotton fabrics. Brass and pewter works, and large iron furnaces and forges, have been established in the vicinity. The trade has been greatly extended by the Liverpool canal. Close to the town, near Scholes bridge, a valuable mineral spring, called Wigan Spa, has been discovered. About a mile north of Wigan is Haigh-hall, the venerable mansion of the Earl of Balcarras. Wigan sends two members to parliament, chosen by about 200 voters. Population of the burgh in 1821, 3176 houses, 3366 families, 3254 do. engaged in trade. Total number of inhabitants 17,716.

WIGHT, ISLE OF. See HAMPSHIRE, Vol. X. p. 233.

WIGTON, a town of England, in Cumberland, is situated on the river Wiza, which runs past the west and north side of the town. It consists of one main street, about three-fourths of a mile long, and some smaller ones, and contains many good houses. The church, built in 1788, is a handsome building. The Sunday school, built in 1820, is an excellent edifice, and holds 400 children. There is also a free grammar school, and an hospital for six widows of protestant clergymen in the county. The manufactures are printed cottons, ginghams, calicoes, checks, &c. One of the chief calico manufactories is at Spittle, a quarter of a mile from Wigton. There are three excellent inns in the town. Population of the township in 1821, 729 houses, 956 families, 128 do. in agriculture, 761 in trade, and total population 4056.

WIGTON, a town of Scotland, and the capital of the county of the same name, is situated on an abrupt eminence about 200 feet above the level of the sea, on the western banks of Wigton Bay, within a quarter of a mile from the mouth of the river Bladenoch. The town extends in a sloping direction from almost the summit of this hill, till within 180 feet of the bay. Wigton was never a place of much opulence or commercial importance, and no thoroughfare is connected with it. It consists principally of one street, fully a quarter of a mile in length, running nearly from west to east, of the usual width at the two extremities, but diverging so in the centre as to leave a vacant space of considerable extent. Till about the year 1810, this space was public property, uninclosed, and serving as a cattle market; but about that time it was enclosed nearly in the form of a parallelogram, planted with shrubs, evergreens and forest trees, beautified with broad walks, having a large bowling green in the centre. It is distant 105 miles south-west from Edinburgh, its latitude being 54° 52′ north (nearly on the same parallel as Durham), and its longitude 4° 22′ 30″ west.

Wigton was made a royal burgh in the reign of David II. This honour was probably conferred upon it in 1341, when it was established as the chief town of the earldom or county of Wigton, conferred on Sir Malcolm Fleming. The county (but not the title), with its capital was thirty years afterwards sold to Archibald Douglas, Lord of Galloway; and on the forfeiture of this family, annexed to the crown in 1453. In 1581, it is specified as one of the king's *free burghs* in the west. But Wigton was a place of importance long before it was erected into a royal burgh. It must have existed previously to 1267, when Dervorgille, daughter of Allan, Lord of Galloway, founded there a monastery for black nuns, as it is then mentioned by its present name as a place well known. The castle of Wigton, which belonged to the king, is spoken of as an important fortress about the latter period, and Chalmers thinks it was built at least a century before that date. This castle was in the hands of Edward I. in 1291, being delivered to him till the claims of the different competitors for the crown were decided. He committed it to the charge of Walter de Currie (laird of Dunskey), and successively of others, and ultimately conferred it on John Baliol as the Scottish king. This castle has now disappeared; but it is understood to have been situated on the banks of the Bladenoch south of the town, at a place where in ancient times that river fell into the bay. The fosse is quite discernible; and though the foundation of the walls cannot be traced, mortar and other remains, indicative of an ancient building, are still to be observed. The monastery founded by Dervorgille was situated on the east of the burgh, terminating on an abrupt ridge overlooking the bay, but no remains of it can be traced. There was a large cemetry connected with it, where, within these fifty years, bones and other sepulchral remains were dug up. The friars of this place, though they had to profess poverty and practice mendicity, were possessed of considerable property, originating for the most part in temporary grants of fisheries, lands, &c. and of gratuities given them by the various kings of Scotland who lodged with them on their pilgimage to St. Ninian's tomb in Whithorn. In 1502, James IV. gave 14 shillings to the pipers of Wigton for music. And the subsequent year he presented the priest of Wigton with 40 shillings to perform "a Dirge and Soul-mass" for his brother John, Earl of Mar, of whose death he there first got intelligence. The first church in Wigton was consecrated to St. Machute, an obscure saint, who died in 554. It originally belonged to the priory of Whithorn, but was afterwards a free rectory, of which the king was patron. There is a MS. in the Advocates' Library (Jac. V. 8. 8.) containing curious notices relative to religious houses; among other things, a donation (1495) is mentioned from William M'Garvey, vicar of Penningham, of various houses and crofts in or near the burgh (which are most minutely described), to support "a chaplaine in St. Machutus in Wigtoun." When the present church was built, we have not ascertained; the east gable is of great antiquity, being the remains of a former building, probably that of the church of the venerable St. Machute. In the churchyard are several ancient monuments and inscriptions, particularly one or two which seem to have been transferred thither from the cemetry of the monastery.

The inhabitants, with the exception of a few Irish settlers, are nearly all natives, either of the burgh or county. The names of families that are still most prevalent in Wigton, such as M'Kie, M'Kinnell, &c. were the predominant names so early as the year 1495. (Vide the MS. above referred to.) The inhabitants of this place are extremely respectable, and no where can be found more interesting and refined society. They are generally in comfortable circumstances in their respective stations, and some of them have attained considerable opulence. Property is much subdivided: there are few steady tradesmen that are not proprietors of a house; and the numerous crofts, or *acres* as they are called, adjacent to the burgh, are the property of the various classes of the citizens. They are a reading, inquisitive people; and while they have had for above thirty years a large subscription library, not a few of them possess extensive private collections. Crime is nearly unknown, and the obligations of piety and morality are held sacred. There is, in addition to the parish church, a dissenting chapel. The burgh school has long been eminent; and there are not wanting instances of individuals educated at this seminary that have attained to distinction and honour in various quarters of the world. Wigton, with New Galloway, Whithorn and Stranraer, send a member to parliament. The population amounts to about 1000. Vide *Caledonia;*

Murray's *Lit. Hist. of Galloway;* and the Rev. Mr. Donnan's account of this place in the *Stat. Acc. of Scotland*, vol. xiv. (T. M.)

WIGTONSHIRE. About the etymology of the term Wigton there have been many conflicting conjectures. Without dwelling on these, we think it sufficient to mention that to us it seems composed either of the Gothic term *wic*, a turret, a fortress, a castle, and *ton* or *tun*, a dwelling, a village; a castle having stood near the site of the present Wigton at an earlier period than can be ascertained, and the town, when built, would naturally take its name from the fortress; or of the Anglo-Saxon word *waeg*, a wave, a billow, a sea, a way, and *ton* as above; and this appellation it might obtain from its situation on the banks of a large arm of the sea. The county would, as in so many other instances, take its name from the chief town; this district, indeed, was not erected into a county until 1341, long before which the town of Wigton had become a place of importance. It is sometimes called West Galloway, or the shire of Galloway, the stewartry of Kirkcudbright being denominated East Galloway: the two being known by the common name of Galloway.

This county is bounded on the east by Wigton Bay and the river Cree, which separate it from the stewartry of Kirkcudbright; on the south by the Irish sea; on the west by the Irish channel; and on the north by Ayrshire. It is situated between 54° 38′ and 55° 4′ north latitude, and between 4° 16′ and 5° 6′ west longitude. Its length from east to west is 34 miles; its breadth from north to south nearly the same; its mean breadth about 24 miles. It is divided into three districts,—the Rhyns (signifying peninsula), which lies west of a line drawn between Luce Bay and Lochryan; the Machers (or flat country), lying between the Wigton and Luce Bays; and the Moors, which include the remainder, being more than the half of the county. No part of the shire is above 13 miles from the sea.

The climate is regarded as salubrious, though subject to considerable variations. There are many instances of longevity: Alexander Credie, a native of the Machers, died in 1824 at Sorbie, at the venerable age of 108.

The number of inhabitants in 1755 was 16,466; in 1811, they had increased to 26,891; and in 1821, to 33,240. The number of square miles in the county being 459, there is 72 inhabitants to each square mile. Taking Scotland altogether, it averages 79 to a square mile. The people of this county are industrious, moral, intelligent and enterprising. With the exception of Irish settlers, who form a numerous class, the greater number of the present inhabitants can trace back their descent through many generations. They are originally, as shall be mentioned hereafter, a Celtic people; and it is a curious fact that they retained their early predilections so long that the Gaelic was their vernacular dialect in the time of Queen Mary, when it was unknown in every other district in the south of Scotland. This speech was not disused in the remoter parishes even at the beginning of the 17th century; and if tradition may be relied on, it is not more than a hundred years since it entirely disappeared in the parish of New Luce. The inhabitants of this county have from the remotest antiquity been a warlike people. Their continual hostility with the Scottish monarchs for ages previously to the death of Alexander III. and their achievements during the wars that followed that event, are recorded in the history of their country. Their cooperation was so much valued by the kings of Scotland, that to obtain it they conferred on them the honour (common to them and the people of the rest of Galloway), of forming the van at every battle at which they might be present. The chiefs of many of the most distinguished families, with their followers, fell at the battles of Bannockburn, Halydon Hill, Flodden, Pinkie, &c. Nor have they in modern times been less distinguished for their bravery and military skill, though it might seem invidious to refer to particular examples.

The physical appearance of Wigtonshire is not very striking. Though there are eminences and hills of considerable height, yet it has been remarked that there is no county in Scotland that rises so little above the level of the sea. There are no important rivers belonging to the county. The Cree, which rises in Ayrshire, terminates in the Wigton Bay, after being navigable for about four miles. The Bladenoch, which rises in Loch Mabearrie on the frontiers of Ayrshire, and which receives the tributary streams of the Tarff and Malzie, after a winding course of about 20 miles, falls into Wigton Bay near Wigton, being navigable only for a mile and a-half. The only two rivers worth mentioning, are the Luce and Piltanton: the former, rising in Ayrshire, falls into the Luce Bay near Glenluce; the latter has its source in the parish of Portpatrick, and joins the sea on the west of the same bay: neither of them are navigable. The county has a southern exposure, and the rivers flow in that direction nearly parallel to each other.

But though not possessing large or navigable rivers, this county abounds with the most spacious bays and harbours. Wigton bay, which lies on the east, is a noble estuary, gradually varying from seven or eight miles in width, till it terminates in the Cree, a distance of about ten miles. Luce bay forms an indentation on the south of about fifteen miles, its width regularly graduating from twenty miles till it reaches near the town of Glenluce, where it terminates. These bays form two remarkable promontories,—the Borough head, in the south-east, and the Mull of Galloway on the south-west, —the two most southerly points in Scotland, the latter being about a mile and a-half farther south than the former. Lochryan, an arm of the sea, lies on the north-west corner, extending into the country about nine miles, and varying from two to four in breadth. These estuaries are distinguished by numerous and excellent harbours. On the western shore opposite to Ireland, are the harbours of Portnessock and Portpatrick. Of the vast improvements now executing at the latter of these, we have given an account in our article PORTPATRICK; and at the former, Colonel M'Dowall has commenced similar improvements at his own private expense;

so that these two places, when finished, will probably be superior to any other harbour on the western coast of Scotland. In this county, the fresh water locks, though numerous, are extremely small. Dowalton or Longcastle in the Machers, which is probably the largest, is about two miles long by one in breadth.

The soil varies much in the different divisions of the county. The lower grounds, particularly those on the coast, are very rich and fertile; while the higher soils, though mostly arable, are thin, gravelly, and unproductive. The barony of Baldoon in the Machers, stretching south from the Bladenoch along the Wigton bay, is the Carse of Gowrie of the south. The Rhyns also is extremely rich, though from the sandy nature of the soil in some places, the crops are very precarious, and hence in that district prices often differ much from those of the rest of the county. The most improved system of agriculture is every where pursued, though the best specimens may be found on the estate of Baldoon. Of the relative proportions of land in crop and in pasture, we have a correct idea from the fact, that out of 288,960 English acres which the county contains, 101,136, or 35 per cent, are under cultivation, and 187,824, or 65 per cent, in pasture. It may not be improper to state, that property in land is here very little subdivided. There are four or five large proprietors whose united estates comprehend the half of the whole county, and compared with other shires, there are few whose estates vary from £500 to £1000 of rental. Agriculture, though now brought to perfection in Wigtonshire, was, till within less than a century, in a very rude state. Marshal Stair was the first to introduce agricultural improvements into this county, as his sister, the countess of Loudon (who died in 1770 aged 100), did into Ayrshire. This celebrated general in 1728 retired from public business, and spent the remainder of his days either in the counties of Wigton or Linlithgow (in both of which he had a residence), in the quiet pursuits of private life. He adopted the most approved modes of cultivation he had witnessed either in England or on the continent. He practised the horse-hoeing system: he introduced the Lucerne and Saint Foin grasses; in addition to potatoes, he cultivated turnips, carrots and cabbages with the plough: he subdivided and enclosed his lands: drained swamps and mosses: and altogether exhibited a skill and an enterprize such as to effect a revolution in agriculture in the two counties in question. Lord Stair died in 1747, but the influence of his example continued: and since his death, Wigton has had the advantage of various skilful agriculturists, both landlords and tenants, to whom she is deeply indebted. Two agricultural societies have long existed in Wigtonshire; and the present race of farmers, in point of intelligence and professional skill, are highly respectable.

Notwithstanding what hath been said respecting the harbours and other advantages of this county, it has little or no trade or manufactures. Though it is the seat of three branches of the customhouse, introduced in 1710—(namely at Wigton, Stranraer, and Portpatrick), yet this is owing to the prevalence of smuggling from Ireland and the Isle of Man, as much as to its commercial importance. At the Revolution, Wigtonshire had no shiping except three or four vessels, chiefly for fishing, belonging to Stranraer. And such has been its improvement, chiefly of late, that in 1819 it could boast of 106 vessels admeasuring 4312 tons, averaging upwards of forty tons each. Of these vessels, seven are employed in foreign trade, mostly with Canada; twelve in the fishing trade, for which purpose they pay an annual visit to the shore of the Western Highlands; and eighty-seven in the coasting trade. The chief imports are black cattle and horses from Ireland, chiefly for the English market; coals, lime, merchant-goods, slate, free-stone, iron, with wood from Canada; the chief exports are the produce of agriculture. There are no manufactures carried on in Wigtonshire except for home consumption.

Wigtonshire is not distinguished for mineral wealth. No mines of any kind have been found, with the exception of a copper mine near the Borough-Head, which the proprietor has lately begun to dig. Quarries of coarse slate has been met with, but none of good quality; and slate is still imported.

This county abounds with burghs and villages,—of which, we have already given an account of Portpatrick, Whithorn, and Wigton. (See these articles). Stranraer, the next in eminence, is beautifully situated on a plain at the head of Lochryan. It was constituted a royal burgh by James VI. in 1617; but owing to the invidious interference of Wigton, which dreaded it as a rival, its charter, it is supposed, was not confirmed till the time of William and Mary. It forms the great thoroughfare to Ireland; it is larger than any other town in the county, its population being above 2000. Glenluce stands about 500 yards from the Luce, at the head of the bay of that name. The population may be about 500. Newton-Stewart lies on the banks of the Cree, eight miles north of Wigton, and contains about 1200 inhabitants. Garlieston, about the same size as Glenluce, lies on the west of the Wigton bay. The Isle of Whitborn, on the same bay, southward, is, properly speaking, the port of Whithorn, from which it is distant about three miles. Fort-William, a small place, but possessing a good harbour, is on the east coast of the Luce bay.

But Wigton is distinguished for nothing so much as the antiquity and number of its religious houses. The oldest church in Scotland was built near the site of the present Whithorn, as mentioned in our account of that burgh; and in the 12th century a monastery was founded there by Fergus, Lord of Galloway. The same person established another called Saulseat—(*sedes animarum*)—near Stranraer. Rolland, Lord of Galloway, founded, in the same century, the abbey of Glenluce; and the abbey of Wigton was established in the 13th century by Dervorgille, daughter of Allan, last Lord of Galloway, and mother to John Baliol, the Scottish king. There were also numerous churches and chapels of inferior note founded at or before the time when these monasteries were erected. Wigtonshire at the Reformation contained twenty-one parishes, with various subsidiary chapels, either the property of some baron, or built for the advantage of the remote inhabitants of a large parish. These chapels have long been disused, and in most cases even their ruins have disappeared: parishes have been more judiciously arranged: in some cases, three, being annexed, form one; and though three *new* parishes have been erected—(Kirkcowan, Stranraer, Portpatrick)—the number is reduced to seventeen.

From the ecclesiastical importance of this county, its most celebrated characters have been of the sacred profession. St. Ninian was a native of Leucophibia or Whithorn, where, after studying at Rome, he founded the first church built in Scotland. Gavin Dunbar, tutor to James V. and afterwards archbishop of Glasgow, was son to Sir John Dunbar of Mochrum. Some illustrious men, both clergymen and laymen, such as Archbishop Beaton, Bishop Gordon (archbishop of Athens), Bishop Cowper, Lord Stair the famous lawyer, his son, the first Earl of Stair, and grandson, Marshal Stair, were connected with Wigton by office, or by the possession of property. Dr. M'Gill of Ayr, a celebrated divine, was a native of this county. Among the laymen born here may be mentioned Sir Patrick Vans of Barnbarroch, ambassador to Denmark in the time of King James VI., and a Lord of Session; Patrick Hannay the poet, son to Hannay of Sorbie; Andrew M'Dowall, Lord Bankton, author of Institutes of the Law of Scotland; and Major Stewart Maxwell, author of the "Battle of the Bridge."

The most of the landholders of Wigtonshire are descended of families connected for centuries with this county. The ancient lords of Galloway will be afterwards mentioned; but whether their race has become extinct, or whether any family can claim descent from them, is a question that has long been agitated, and from its nature can never be completely ascertained; but it seems to be generally allowed, that the M'Dowalls of Wigtonshire have that honour. (*Caledonia, III.* 379.) They bore the same arms as the ancient princes of Galloway; and Fergus, Uchtred and Duncan, names in the old family of Galloway, were also the prevailing names of the M'Dowalls. They have been a powerful race in Wigtonshire since the middle of the 13th century, and were particularly conspicuous on the side of Baliol during the succession wars. The name is still eminent, but the number that bear it is reduced: for in the list of freeholders of the county there are only three M'Dowalls; while in the 17th century there were no fewer than thirteen. The M'Cullochs of Myreton, as ancient and powerful as the M'Dowalls, also supported the claims of the English monarch, and espoused the cause of the Baliols. In 1337, Edward III. granted Patrick M'Culloch an annual pension of £20 for his good services in Scotland; and he subsequently gave him other marks of his favour and gratitude. The last of the Myreton line, Sir Godfrey M'Culloch, was beheaded for murder in 1697; but several gentlemen of the same name, lineally descended at various periods from the original stock, are landholders in Galloway. The Hannays (of Sorbie and Mochrum), and the M'Kies are also of very old descent. These are the oldest families, but there are others of nearly equal antiquity. The Adairs, the Agnews, the Kennedys, all of Irish extraction, the Stewarts, the Dunbars (descended from the earls of March), settled in this county 500 years ago. The first charter in favour of the Vanses was in 1452. The Maxwells (from the house of Nithsdale) were established here in the same century. The Gordons, of whom not fewer than twelve were landholders in Wigtonshire in the time of Charles I. were originally of the house of Lochinvar in the stewartry: and the various families of M'Lellans were of the house of Bombie, in the same county. The Murrays of Broughton (of illustrious descent in Dumfries-shire, and now representing in the stewartry the Stewarts, knights of Cally, and the Lennoxes of Plunton), the Hays of Park, the Rosses, the Blairs of Dunskey, the Dalrymples of Stair, the Cathcarts of Genoch, the Hathorns, first appear in the annals of Wigton in the 16th or 17th centuries. The connection with this county of the Flemings, earls of Wigton, and the Douglasses, as shall soon be shown, was but short; the former only for thirty years: the latter for less than a century. The Ramsays of Boghouse, the Nelsons of Craigcaffie, the Christians of Monkhill and Drummaston, the Houstons of Culreoch, the Martins of Cutcloy and Airies, the Baillies of Dunragget, have either become extinct, or have terminated in females, or have now no property in Wigtonshire. There were persons of the name of Christian (sometimes spelled M'Christian or Christie, which is still a common name), that possessed tenements in the burgh of Wigton and crofts in the neighbourhood before 1449. The Christians of Monkhill are now represented by Mr. Christian Curwen of Cumberland. There are also M'Kerlies, a name common here since the days of Wallace, but which, so far as we know, occurs in no other district in Scotland. The oldest names, in addition to those already mentioned, are M'Guffie, M'Kinnen, M'Keand, M'Gowan, M'Geoch, M'Nish, M'Gill, M'Cracken, Milwain, Milbench, Clumpha, Broadfoot, Dickson, Donnan, the most of which are evidently Celtic, and must have come down from the remotest antiquity.

The history of this county, had we room to tell it, would be interesting. The aborigines were of Celtic origin. They were invaded by the Romans; and the geography of the district has been given by Ptolemy and others. The inhabitants were named *Novantes:* their chief towns were *Rerigonium* on the *Rerigonius sinus*, or Lochryan, and *Leucophibia*, the present Whithorn. The Mull of Galloway they called *Promontorium Novantium*, the Luce bay *Abravannus sinus*, the Wigton bay *Jena fluvius*. On the abdication of the Romans, the Celts again obtained possession of the county. They were frequently invaded by the Gothic inhabitants of Scandinavia, and were partially conquered by the Anglo-Saxons of Northumbria. They were never, however, completely subdued, and it is questionable whether, in the earlier periods of their history, they owned subjection even to the Scottish kings. They, at least, under the sway of their own independent lords or princes (for about a century previously to the death of Allan, their last lord, in 1234), revolted, and carried on war against their sovereign, with various success. On the death of Allan, his power and domains were subdivided among his three daughters,—which introduced new families and new customs. John Baliol, the Scottish king, was grandson of Allan, and possessed great estates in Wigtonshire. The most powerful families of this province (the M'Cullochs, the M'Dowalls, the Hannays, the Adairs,) swore fealty to Edward I. and he appointed Thomas M'Culloch sheriff of the county. This county, with the title of earl, was conferred by David II. in 1341 on Sir Malcolm Fleming: but Fleming, amid the disasters of the times, was obliged, in 1372, to dispose of his estates (though he retained the title) to Archibald Douglas. From this period the Douglasses ruled supreme till their forfeiture in 1453. The county was then parcelled out among different families, most of which still remain: and the Agnews of Lochnaw were created heritable chiefs. The office remained in that family till the abolition of hereditary jurisdictions in 1747, with the exception of 17 years previous to the Revolution, when the infamous Graham of Claverhouse and his brother were appointed joint sheriffs.

See the *Statistical Accounts* of the several parishes; *Caledonia*, iii. § *Wigton;* Symon's *Galloway;* Smith's *Survey;* Murray's *Galloway*. (T.M.)

WILCOX, county of Alabama, bounded S. by Monroe; S.W. by Clarke; N.W. by Marengo; N. and N.E., by Dallas; E. by Montgomery, and S.E. by Butler. Length, from E. to W., 60 miles; mean breadth 20, and area 1200 square miles. Extending in Lat. from 31° 49′ to 32° 15′, and in Long. from 9° 56′ to 10° 56′ W. from W. C. Declivity S.W. and traversed in that direction by Alabama river; chief town, Canton. By the post-office list of 1831, there were post-offices at Allentown, Barge's, Black's Bluff, Canton, Daletown, Lower Peach Tree, Upper Peach Tree, Mott's, Norrisville, and Womacks. Population in 1820, 2917, in 1830, 9548. DARBY.

WILKES, JOHN, a celebrated political character, was born in London in 1727, and died in 1797. See our Article BRITAIN, Vol. IV. p. 613-617, and Almon's *Memoirs of John Wilkes.*

WILKES, county of North Carolina, bounded N.E. and E. by Surry; S.E. by Iredell; S.W. by Burke, and W.N.W. and N. by Blue Ridge, separating it from Ashe. Length from S.W. to N.E. 48 miles; mean breadth 18, and area 864 square miles. Extending in Lat. from 35° 56′ to 36° 24′, and in Long. from 3° 51′ to 4° 35′ W. from W. C. This county is a real mountain valley, environed on every side, but to that of the northeast, by the Blue Ridge and adjacent chains. It is commensurate with the extreme higher valley of Yadkin river, by the confluents of which it is entirely drained. Declivity northeastward; chief town Wilkesville. By the post-office list of 1831, there were post-offices at Brier creek, Fort Defiance, New Castle, and Wilkesborough. Population in 1820, 9967, in 1830, 11,968.

WILKES-BARRE, borough, post town, and seat of justice, Luzerne county, Pennsylvania, stands on a high bank, right side of Susquehanna river. about 120 miles N.N.W. from Philadelphia, and by post road 222 N.N.E. from W. C. and 114 N.E. from Harrisburg. N. Lat. 41° 13′, Long. 1° 7′ E. from W. C.

Wilkes-barre was laid out about the year 1775, by Col. John Durkee, who imposed the compound name as a grateful tribute to two eminent members of the British parliament, for their exertions in favour of the North American colonies. The plan is perhaps entirely singular. The streets form a parallelogram, extending along or at right angles to the river; in the centre is a public square, containing the county buildings, but this square stands at an angle of 45 degrees to the streets; form of the latter extending from each corner of the former. The western angle of the square is opposite a bridge over the Susquehanna, with a portion of the main street intervening. The bridge connects Wilkes-barre with the village of Kingston. Population of Wilkes-barre in 1830, 2232.

WILKES-BARRE, valley of, usually called the valley of Wyoming, is amongst the natural scenes in the United States that richly deserve a visit. The Susquehanna river may be said to rush into and break through the Appalachian system of mountains. Passing the first great chain at Towanda, the large volume of water in its rocky bed rolls through several other chains in quick succession, at length reaches Wyoming valley at the mouth of Lackawannoc river, by a very striking mountain gorge, inflecting at right angles, and turning from S.E. to S.W.; the stream with very gentle partial windings flows down the Wyoming valley nine miles, passes Wilkes-barre and Kingston, and six miles farther leaves the valley by another mountain pass. The bed of Susquehanna merely touches the western river of this vale, which is indeed extended up the Lackawannoc, and to the southwestward, some miles below where it is abandoned by the river. The valley is distinct, therefore, 25 miles above and seven or eight below the borough of Wilkes-barre, exceeding 30 miles in length, but with a width that does not at the utmost exceed a mean of two and a-half miles. Enclosed between mountains every where steep and rugged, in many places precipitous, and in some rising into naked summits, spreads alluvial flats of exuberant fertility. Here, as along the Susquehanna generally, there are two stages of bottoms. The lower, and of course most recent, are much the most productive, and least admixed with rounded pebble, but are still subject to casual submersion. The higher stages, on one of which stands Wilkes-barre, are, in the existing order of things, above all floods, but both have been evidently once under water. This conclusion is almost irresistible to any observer in the vicinity of Wilkes-barre. In brief, it may be asserted that many of our citizens who admire natural scenery, know the wealth of the Alps in objects of taste infinitely better than they do regions at their door. The Wyoming is only one of the innumerable pictures along the Appalachian system where are combined every feature, from the stern to the most soft and seducing. Again, in the vicinity of Wilkesbarre and Kingston, the mineral curiosities are not the least attractive. The formation is transition or leaning; the inclination S.E. Embedded in slate from one to twenty or more feet in thickness lie masses of anthracite coal, which appear more and more vast as they are better explored.

WILKESBOROUGH, in the post-office list, but Wilkesville on Tanner's U. S. Map, post village and seat of justice, Wilkes county North Carolina, situated on the right bank of Yadkin river, 51 miles N.E. from Morgantown, in Burke county, and by post-road 175 miles a little N. of W. from Raleigh. N. Lat. 36° 10′, Long. 4° 8′ W. from W. C.

WILKINSON, county of Georgia, bounded S. E. by Laurens; S.W. by Twiggs; N.W. by Jones; N. by Baldwin, and E. by Oconee river, separating it from Washington. Length from N.W. to S.E. 24 miles; mean breadth 18, and area 432 square miles. Extending in Lat. from 32° 37′ to 33° 02′ N., and in Long. from 6° 2′ to 6° 30′ W. from W. C. Declivity southeastward, towards the Oconee. Chief town, Irvinton. Population in 1820, 6992, in 1830, 6513. By the post-office list of 1831, there were post-offices at Cool Spring and Irwinton.

WILKINSON, county of the state of Mississippi, bounded by the Homochitto river, separating it from Adams county, on the N.; and Franklin N.E.; by Amite county E.; by the parish of East Feliciana in Louisiana S.E.; by West Feliciana in Louisiana S.; and by the Mississippi river separating it from the parish of Avoyelles in Louisiana W.; and the parish of Concordia Louisiana N.W. Greatest length from E. to W. 30, mean breadth 20, and area 600 square miles. Extending in Lat. from 31° to 31° 14′ N. and in Long. from 14° 12′ to 14° 46′ W. from W. C. The general declivity of this county is westward, but the extreme southern border declines in a southern direction, giving source to Thompson's creek, and Bayou Sara. Buffaloe creek rises on the eastern side, and flowing westward, divides the county into two nearly equal sections. The surface is very much broken by hills, however, of no great elevation. Soil excellent. Principal staple, cotton; chief town, Woodville. By the post-office list of 1831, there were post-offices at Cold Spring, Fort Adams, Kellertown, Mount Pleasant, Percy's creek, Pinckneyville, Rose Hill and Woodville. Population 1820, 9718, in 1830, 11,686.

WILLIAMSBURG, post town, and seat of justice, James City county Virginia, situated on the summit level between York and James rivers, by post road 60 miles S.E. by E. from Richmond. N. Lat. 37° 16′ and Long. 0° 20′ E, from W. C. The post road distance from W. C. 163 miles.

This little city, though it has not advanced much in wealth or population, has many very interesting claims on the student of U. S. Geography. It was the cradle of our political existence, and for a long period the seat of government of "Infant Virginia." The college of William and Mary, in Williamsburg, was founded in 1693, and with various fortunes of advance and recession, has continued to exist as a respectable literary institution. By the original charter, this college was endowed with a clear and certain revenue of £3000 per annum. Recent attempts have been made to revive the former prosperous condition of this seminary. Population of Williamsburg in 1820, 1402.

WILLIAMSBURG, district of South Carolina, bounded N.W. by Sumpter; N.E. by Lynche's creek, separating it from Marian; E. and S.E. by Georgetown district; and S.W. by Santee river; separating it from Charlestown district. Length between Santee river and Lynche's creek, 40 miles, mean breadth 30, and area 1200 square miles. Extending in Lat. from 33° 15′ to 34° 02′ N. and in Long. from 2° 24′ to 3° 12′. The declivity is southeastward, in the direction of Lynche's creek, Santee river, and Black river. The latter stream rising in Sumpter, traverses Williamsburg, at a mean distance of 16 or 17 miles from Santee river. Chief town, Kingtree. Population in 1820, 8716, in 1830, 9018. DARBY.

WILMINGTON, a post-town of New Castle county, Delaware, is situate on a point just above the junction of Brandywine and Christiana creeks, about 28 miles S.W. from Philadelphia, and by post road 108 N.E. from Washington City. Lat. 39° 44′ 15″ N., Long. 75° 32′ 45″ W.

The site of the town is of considerable acclivity, being on the dividing ridge between the waters of those streams; the summit is 109 feet above tide water, from which there is a fine prospect of the surrounding country and of the river Delaware, about three miles distant; it is much the largest town of the state in which it is situate, and, except Philadelphia, the most extensive in the basin of the Delaware. The streets cross each other at right angles; the side walks are generally paved with brick, and the carriage ways of some of the principal streets with stone. The buildings are generally good, and some of them very neat and capacious.

Wilmington was for many years past a borough town; but has the present year (1832) received a city charter. Its limits embrace an area of one mile from N. to S. and one and a-half from E. to W. It is under the government of a mayor, an alderman, and city council, composed of 12 members, four of whom are elected annually by the citizens, to serve for three years; this body has power to enact the necessary laws for the government of the city. They also elect the mayor and alderman, the former for a term of three years, and the latter for five years.

There are also two courts for the trial of city causes; the mayor's court possessing criminal, and the city court civil jurisdiction. The mayor and alderman and president of the council, preside in each of these courts.

Wilmington, though a port of entry, has not an extensive commerce with foreign countries; but is the centre of a large manufacturing district; it has three banking establishments, viz.

	Capital.
The Bank of Delaware, -	$110.000
Bank of Wilmington and Brandywine,	130,000
Branch of Farmer's Bank of Delaware,	200,000

The Bank of Delaware was the first established in the state, and is one of the oldest in the United States, its charter having been granted in 1796; its business has been extensive and ably conducted, and few banking institutions in the country have proved as profitable an investment for their stockholders. It has within a few years erected a very neat and commodious banking house, attached to which is a dwelling for the cashier. There are also two fire insurance companies, with an aggregate capital of $250,000.

There are 13 houses for public worship; viz. three Episcopalians, two Friends, three Presbyterian, one Baptist, one Roman Catholic, and three Methodists, two of which latter belong to coloured congregations.

The public buildings are, a United States arsenal, the city hall, a college, a poor house, and two market houses, at which a market is held twice in each week alternately; they are well supplied with meats, fruit and vegetables. The poor house is erected on a healthy and elevated situation, a short distance west of the town, and is well adapted to the purposes intended. There is also a public library and academy of natural sciences, in which is deposited a fine collection of minerals.

Among the private literary establishments in this city, there are five boarding-schools, which are generally under the superintendence of competent instructors, and afford ample facilities for obtaining a liberal education; two of these institutions are for young ladies; they have been established for several years, and are eminently deserving of the patronage they have received.

In the vicinity of Wilmington are the falls of the Brandywine, which afford a very extensive water power, from which the city derives an incalculable advantage by an adequate supply of pure and wholesome water.

In 1826 the borough council purchased a large mill on the Brandywine, and constructed machinery by which the water of this stream is forced, a distance of 2120 feet, to two handsome and extensive reservoirs, situate at the summit of the town; from these reservoirs a copious supply of water is distributed to every part of the town by means of iron pipes of various dimensions; the extent of pipes now laid is about five miles. The whole machinery for this work is of perfect construction, and reflects great credit on the skill of the engineer. The cost of the works and property was about $65,000. The mill is occupied as a cotton factory, and the reservoirs are supplied with water at regular periods by the occupant.

The valuable water power of the Brandywine has also been rendered available to a great extent, by the erection of mills and machinery for the manufacture of cotton and woollen goods, flour, paper, snuff, gun-powder, iron, and various other articles.

Population of Wilmington in 1820, 5268, in 1830, 6663. Ed.

WILSON, county of Tennessee, bounded by Smith E.; Warren S.E.; Rutherford S.; Davidson W.; and Cumberland river N., separating it from Sumner. Length 38, mean breadth 14, and area 432 square miles. Extending in Lat. from 35° 58′ to 36° 20′ and in Long. from 9° to 9° 44′ W. from W. C. Declivity a little W. of N. towards Cumberland river; chief town, Lebanon. Population in 1820, 18,730, in 1830, 25,472. Darby.

WILSON, Alexander, M.D. late Professor of Practical Astronomy in Glasgow College, was a younger son of Patrick Wilson, town-clerk of St. Andrews, and was born there in 1714.

Having received the usual education at the different schools, he entered the College of St. Andrews, where he made great proficiency in literature and the sciences, and, after completing a regular course of studies, he was admitted to the degree of Master of Arts in his nineteenth year.

Upon his leaving the college, he was put as an apprentice to a surgeon and apothecary in his native city, with a view of following that profession. At this period he became more particularly known to Dr. Thomas Simson, professor of medicine in the university, who ever after treated him with much kindness and friendship.

In 1537 Mr. Wilson departed from St. Andrews, and by the advice of his friends went to London, in order to seek for employment as a young person who had been bred to the medical profession. Soon after his arrival there, he engaged himself with a French refugee, a surgeon and apothecary of good character, who received him into his family, giving him the charge of his shop, and of some of his patients, with a small annual salary. About twelve months after he had been fixed in this new situation, Mr. David Gregory, professor of mathematics at St. Andrews, coming to London, introduced him to Dr. Charles Stewart, physician to Archibald, Duke of Argyle, then Lord Isla.

A circumstance of a very accidental nature occurred, which gave a new direction to his genius, and which in the end led him to an entire change of his profession. This was a transient visit which he happened one day to make to a letter-foundry, along with a friend who wanted to purchase some printing types. In the course of seeing the common operation of the workmen usually shown to strangers, he was much captivated with the curious contrivances made use of in that business. Some short while afterwards, when reflecting upon what had been shown in the letter-foundry, he was led to imagine that a certain great improvement of the art might possibly be effected, and of a kind, too, that, if successfully accomplished, promised to reward the inventor with considerable emolument. His ideas upon that subject he presently imparted to a friend a little older than himself, who had also come from St. Andrews, and who was possessed of a considerable share of ingenuity, constancy, and enterprize. The consequence of this was, a resolution on the part of both these young adventurers to relinquish, as soon as it could be done with propriety, all other pursuits, and unite their exertions in prosecuting the business of letter-founding upon an improved plan.

It was not long ere they were enabled to carry into effect this resolution, and they first established a small type-foundry at St. Andrews, and one on a larger scale, two years afterwards, at Camlachie, a village near Glasgow.

In this situation Mr. Wilson had contracted habits of intimacy and friendship with several persons of the most respectable character, particularly with the professors belonging to the university of Glasgow, and with Messrs. Robert and Andrew Foulis, university printers. The growing reputation of the university press, conducted by these gentlemen, gave additional scope to Mr. Wilson to exert his abilities in constructing their types, and being now left entirely to follow his own judgment and taste, his talents as an artist became every year more conspicuous. When the design was formed by the gentlemen of the university, together with Messrs. Foulis, to print splendid editions of the Greek classics, he, with great alacrity, undertook to execute new types upon a model highly improved. This he accomplished at an expense of time and labour which could not be recompensed by any profits arising from the sale of the types themselves.

Though he thus continued to prosecute letter founding as his chief business, yet, from his great temperance, domestic habits, and activity, he was enabled now and then to command intervals of leisure, which he never failed to fill up by some useful or ingenious employment. One of these in which he took great delight was the constructing of reflecting telescopes; an art which he cultivated with unwearied attention, and in the end with much success.

Among the more advanced students who, in the years 1748 and 1749, attended the lectures on divinity in the university, was Mr. Thomas Melvill, so well known by his mathematical talents, and by those fine specimens of genius which are to be found in his posthumous papers, published in the second volume of the *Edinburgh Essays Physical and Literary*. With this young person Mr. Wilson then lived in the closest intimacy. Of several philosophical schemes which occurred to them in their social hours, Mr. Wilson proposed one, which was to explore the temperature of the atmosphere in the higher regions, by raising a number of paper kites, one above another, upon the same line, with thermometers appended to those that were to be most elevated. Though they expected in general, that kites thus connected might be raised to an unusual height, still they were somewhat uncertain how far the thing might succeed upon trial. But the thought being quite new to them, and the purpose to be gained of some importance, they began to prepare for the experiment in the spring of 1749.

In the year 1752, Mr. Wilson, who had married the daughter of William Sharp, a reputable merchant of St. Andrews, brought his family to Glasgow. About five years afterwards he invented the hydrostatical glass-bubbles, for determining the strength of spirituous liquors of all kinds. From the minutes of a Philosophical and Literary Society, composed of the professors and some of their friends, whose meetings were held weekly within the college, it appears that these hydrostatical bubbles made the subject of a discourse delivered by Mr. Wilson in the winter of 1757. At this time he also showed how a single glass-bubble may serve for estimating very small differences of specific gravity of fluids of the same kind, such as water taken from different springs, or the like. This he did by varying the temperature of such fluids, till the same bubble, when immersed, became stationary at every trial, and then expressing the differences of their specific gravity, by degrees of the thermometer, the value of which can be computed and stated in the usual manner.

In the year 1758 he read another discourse to the same society upon the motion of pendulums. On this occasion he exhibited a spring-clock of a small compass, which beat seconds by means of a new pendulum he had contrived, upon the principle of the balance, whose centres of oscillation and motion were very near to one another. At one of the trials it performed so well as not to vary more than a second in about forty hours, when compared with a very exact astronomical clock near to which it was placed.

Not long after this, he also put in execution a remarkable improvement of the thermometer, which consists in having the capillary bore drawn very much of an elliptical form, instead of being round. By this means the thread of quicksilver upon the scale presents itself broad, and much more visible than it does in a cylindrical bore of the same capacity. The difficulty of constructing thermometers of this kind had nearly hindered him from completing his invention, as the thread of quicksilver was found extremely liable to disunite when descending suddenly in so strait a channel. But, by his long experience, he at last discovered a method of blowing and filling thermometers with flattened bores, which freed them entirely from this defect.

About the same time, also, he conceived the design of converting a thermometer graduated for the heat of boiling-water, into a marine barometer, in consequence of the well-known difference of temperature which water, when boiling, acquires under the variable pressure of the atmosphere. This he effected by making a boiling-water thermometer about a foot in length, with a pretty large ball, and having a thread of quicksilver as broad and as visible as was consistent with a very perceptible run upon small alterations of temperature. The stem of this thermometer he fortified, by inclosing it in a cylindrical case of white iron, having soldered to it, at its lower end, a socket of brass for receiving half of the ball, which afterwards became entirely defended, by screwing to the socket a hemispherical cap. At the other end of the case which environed the stem, there was soldered a tube of brass wide enough to admit a scale of proper dimensions, before which there was an opening in the tube, defended by glass.

The utmost range of the scale he determined by the points, where the thermometer was found to be stationary when the ball, and a certain part of the stem were immersed in water, boiling under the greatest variations of pressure which the climate afforded. The interval so found, he subdivided by other observations into degrees, which corresponded to inches of the barometer, and which were so denominated upon the scale.

In the year 1756, the college of Glasgow, upon the death of Dr. Alexander Macfarlane of Jamaica, a great lover of, and proficient in the sciences, received a legacy of a valuable collection of astronomical instruments, which that gentleman had got constructed at London, by the best artists, and had carried out with him to Jamaica, with a view of cultivating astronomy in that island. The college, upon this, soon built an observatory for their reception, which, by medals placed under the foundation, was called by the name of their generous benefactor; and Mr. Wilson was immediately thought of as a proper person for making the astronomical observations. At this juncture his Grace Archibald, Duke of Argyle, procured his Majesty's presentation, nominating him professor of practical astronomy, with an annual salary of fifty pounds; and accordingly, in 1760, he was admitted to this new office.

In 1769, Dr. Wilson made that discovery concerning the solar spots, of which he has treated in the *Philosophical Transactions of London* for 1774. Not long after he entered upon this new field, the nature of the solar spots was announced by the Royal Society of Copenhagen as the subject of a prize essay. This induced him to transmit thither a paper written in the Latin language, containing an account of his observations, and of the conclusions drawn from them. In return, he obtained the honourable distinction of a gold medal of near sixteen guineas.

He published in the *Philosophical Transactions* for 1783, the second paper upon that subject, wherein, upon the authority of many new observations, he obviates objections, and maintains the reality of his discovery with an entire conviction. The amount of it is, "That the spots are *cavities* or *depressions* in that immensely resplendent substance which invests the body of the sun to a certain depth; that the dark nucleus of the spot is at the bottom of this excavation, which commonly extends downwards to a space equal to the semidiameter of our globe; that the shady or dusky zone which surrounds the nucleus, is nothing but the sloping sides of the excavation reaching from the sun's general surface downwards to the nucleus or bottom."

In March and April 1786, when he had nearly completed his seventy-second year, it became apparent to his family and friends, that his constitution and strength were fast declining. After a gradual decay, which he bore with the utmost resignation, he expired on the 16th day of October.

WILTON, a borough of England in Wiltshire, is situated between the rivers Nadder and Willey, in a fertile and extensive valley. It consists chiefly of a single street formed by the high road from Salisbury to Hindon, and contains neat but ancient buildings. The church is an ancient Gothic structure, and is the only one out of the 12 which it formerly possessed. The other buildings are the town-hall, a methodist and an independent chapel, a free school and the alms-house. Wilton was long celebrated for its cloth and carpet manufactures, but these branches have declined and are replaced by the manufacture of flannels and other woollen fabrics and fancy goods. The first carpet made in England was made at Wilton. At the east end of the town stands Wilton house, the residence of the earls of Pembroke. This is a large pile erected at different times, and in different styles of architecture. It contains an extensive and fine collection of pictures and sculpture. A full description of it will be found in our Article Civil Architecture. Population of the burgh and parish in 1821, 390 houses, 637 families, 78 do. employed in agriculture, 245 in trade, &c., and total population 2058.

WILTSHIRE, an inland county of England. It is bounded on the north by the county of Gloucester, on the east by Berkshire and Hampshire, on the south by Dorsetshire, and on the west by Somersetshire and Gloucestershire. It is about 54 miles long and 34 broad, and contains 1379 square statute miles, and 882,560 square statute acres. It is the 14th county of England in point of size. Its rental and tithe is £810,627 + £88,496, and the annual value of a square mile is £652. It contains 1 city, 29 hundreds, 23 market towns, 304 parishes, and sends 32 members to parliament.

The southern and eastern parts of the county consist of a broken mass of chalk hills entering the county from Berkshire, Hampshire and Dorsetshire, and terminating in an irregular range of rugged banks and insulated masses, intersected by deep valleys excavated by the brooks and streams. The north and west portions resemble at a distance an elevated plain, but it consists of a continual series of fertile eminences, rising occasionally into sand knolls, and descending into smoothsided hollows, and sometimes even extensive valleys. This district is divided into Marlborough Downs and Salisbury Plain, the most remarkable plain in England. Between these two divisions there is a tract of rich land, and to the north of these downs the county is well inclosed, abounding in rich pasture, and producing the excellent Wiltshire cheese. Salisbury Plain is uninclosed, and the land, though chiefly in pasture, produces excellent crops of wheat, barley and turnips, when brought under tillage. Vast flocks of sheep are fed on this uncultivated waste, which is said to produce wild burnet and fine grasses, which yield a superior herbage for sheep. Including the whole summer stock, 500,000 sheep are said to be bred here annually. They consisted formerly of the Wiltshire horned sheep, but the South Down are now generally introduced. Sainfoin is cultivated to a great extent, and it is a general practice with farmers to soil their teams upon vetches. The horses are unusually fine, but are kept at an enormous expense. Hogs are reared in great quantities.

The principal rivers of Wiltshire are the Thames, the Lower Avon, and the Kennet, all of which are navigable; the Upper Avon, the Willey, the Nadder, the Bourne, the Stour and the Brue. The canals are already described in our Article NAVIGATION *Inland*, Vol. XIV. p. 280.

Wiltshire has long been celebrated for its manufactures: those of Salisbury, Wilton Devizes, and Chippenham, have been already mentioned under their respective articles. At Mere and its vicinity a great deal of linen, chiefly dowlas and bed-ticks, is made. Broad cloths, kerseymere and fancy cloths are made at Bradford, Trowbridge, Warminster, Westbury, Melksham and Calne, and in all the adjacent towns, &c. from Chippenham to Heytesbury. Fustians, thicksets, and other cotton goods are made at Albourn, and gloves at Swindon.

This county abounds in Roman, Saxon, and Danish antiquities. The most remarkable of these are the monuments of Stonehenge and Avebury. Stonehenge is at present a ruin, and apparently a confused heap of standing and fallen stones. The whole consisted of two circular rows of huge stones, and two elliptical rows of circular stones, with horizontal stones lying on the outer circle in a continued order all round, and five imposts or horizontal stones on ten uprights of the third row. The whole are surrounded by a ditch and vallum of earth, which is about 15 feet high and within the ditch. There appear to be three entrances through this vallum, that on the N.E. distinguished by a bank and ditch being called the avenue. The upright stones of the outer circle differ in form and size. Their general height is from 13 to 15 feet, and their circumference about 28 feet. Each impost has two mortises in it, corresponding with two tenons on the tops of the vertical stones. The circumference of this circle is about 300 feet, and the original number of stones 30, of which 27, are still standing, but there are now only 6 imposts. At the distance of 8 feet 3 inches within this row is the second row, which seems to have consisted of 40 upright stones. The stones are smaller and more irregular than those in the first row; only 8 are standing, but the remains of 8 are lying on the ground. Within these two circles are the two elliptical rows, the outermost of which is the grandest portion of Stonehenge. It was formed by 5 distinct pairs of *trilithons*, or two large upright stones with a third laid over them as an impost. The largest trilithon, in the centre opposite to the entrance, measured when standing, exclusive of the impost, 21 feet 6 inches high, the one next to it on each side was about 17 feet 2 inches, but the extremes were only 16 feet 3 inches. The inner oval row is supposed to have consisted of 19 uprights. The stones are taller and better shaped than those in the corresponding circle, and incline to a pyramidal form. The most perfect is 7½ feet high, 23 inches wide at the base, and 12 inches at top. The *altar stone*, as it is called, is placed within this oval, forming the centre of the whole. It is 16 feet long, and almost covered by the two side stones of the Great Trilithon. The total number of stones is thus estimated:—

Outer circle . . .	30
Second circle . . .	40
First ellipse . . .	15
Inner ellipse . . .	19
The altar stone . . .	1
Three adjoining the agger .	3
Large stone in the avenue .	1
	109

The prevailing opinion is that Stonehenge is a Druidical monument.

The stone temple at Avebury is considered to have been more extensive than Stonehenge. The greater part of the village of Avebury is surrounded by a deep and wide ditch, and a lofty vallum. Within this enclosure there are some large upright stones and others prostrate. At some distance south of the village are other large upright and prostrate stones, and half a mile west of the former are two more upright. Large masses of these broken stones occur in the houses and walls of the village. For a more minute account of this remarkable monument, we must refer to our Article AVEBURY, Vol. III. p. 93.

The next piece of antiquity in point of magnitude is the Wansdyke, a vast earth work which is supposed to have intersected the county. In one place it is still continuous for 10 or 12 miles, being tolerably entire throughout the range of hills to the south and west of Marlborough; upon other places it is visible only in detached spots. This work is supposed to have enclosed the towns of the ancient Britons; others ascribe it to the Belgae, and others to the West Saxons.

Burrows and Tumuli abound in the county, and are most numerous round Stonehenge and Avebury. There are here three Roman stations, besides various Roman roads, Roman pavements, Roman encampments, and entrenched earthen works. Coins, urns, fragments of sculpture, shields, daggers and ornaments of British, Roman, Saxon and Norman workmanship have been discovered.

The county returns two members two parliament, besides two members for Salisbury, Chippenham, Calne, Cricklade, Downton, Devizes, Heytesbury, Hinden, Great Bedwin, Marlborough, Malmsbury, Ludgershall, Wilton, Wotton-Basset, Westbury and Old Sarum.

The chief towns, &c. of Wiltshire are as follow, with the population in 1821.

	Population.
Salisbury, burgh, . .	8763
Devizes, burgh, . .	4208
Marlborough, burgh, . .	3038

As the population of the other boroughs is not separated from that of the parish, it is impossible to ascertain their relative importance.

The population of the county in 1821 was, houses, 41,782, families, 47,684, do. in agriculture, 24,972, do. in trade, &c. 16,982 total number of inhabitants 222,157. See Davis's *View of the Agriculture of Wilts*, and the *Beauties of England and Wales*, vol. xv.

WIMBORNE-MINSTER, the *Vindogladia* of the Romans, is a market town of England, in Dorsetshire, situated between the rivers Stour and

Allen, each of which is crossed by a bridge. It consists of several irregular streets. The principal ornament is its church, which is built in the form of a cross, with two triangular towers, in which are some old bells with fine tones. It is divided like a cathedral, and is 180 feet long from east to west. Several royal and noble persons were buried here. The other public buildings are the grammar-school, and three meeting-houses for presbyterians, methodists and anabaptists, and a large poors' house. The trade of the town, which is small, consists in the woollen manufacture and knit stockings. Population of the town and part of the parish in 1821, houses 259, families 307, do. in trade 118, total number of inhabitants 1387.

WINANDERMERE, See ENGLAND, Vol. VIII. p. 518.

WINCHESTER, a city of England in Hampshire, and the see of a bishop, is situated on the east declivity of a hill which slopes gradually to the valley of the river Itching. It consists chiefly of one main street, running from E. to W. and intersected with a number of minor streets and lanes. In the middle of the High Street stands the cross, 43 feet high, consisting of three stories, with open arches, niches, pinnacles, &c. The principal building in the city is the cathedral, which exhibits an interesting display of all the varieties of English architecture.* The great central tower rests upon four solid piers, and rises 140 feet above the pavement. The most interesting parts of the building are the choir, the magnificently carved screen in stone work; the chauntries of Cardinal Beaufort and Bishop Waynfleet; Bishop Langton's chapel, Bishop Orleton's chapel, and the celebrated font of black marble, covered with sculptures. Many sovereigns and eminent persons have been interred in the cathedral. In the 12th century Bishop Blois collected the remains of the principal of them, and deposited them in six wooden chests, inscribed with their names and epitaphs. St. Lawrence church, near the cross, is considered the mother church of the city, and has a lofty square tower with five bells, but the chief parochial church is that of St. Maurice, which has two aisles. St. Thomas's is an ancient edifice. The other churches are St. Swithin's, St. Peter's, St. John's, with a good tower, and St. Martin's. Beside the churches of the establishment, there are various meeting houses for dissenters, the finest of which is the Roman Catholic chapel, built in 1792. The other public buildings are the town hall, rebuilt in 1713, a neat market house, erected in 1772; and St. John's house, a charitable foundation, in the great hall of which public feasts and assemblies are held. The ancient chapel is now used as a free school. A large and commodious county goal has been some years ago erected on the north side of the city, and there is also a bridewell for the city and another for the county. The theatre, which is a handsome edifice, was built in 1785. Winchester college, founded by Bishop Wykeham was completed in 1393. It consists of a warden, 70 scholars, 10 secular priests, or perpetual fellows, 3 parish chaplains, 3 clerks, 16 choristers, and a first and second master. The buildings occupy a considerable space of ground, consisting principally of two courts and a cloister. The first court is entered by a spacious gateway, and the second by a tower gateway. The chapel and hall form the south wing of the quadrangle. The library is in the centre of the cloister, and the hall is in the S.W. corner of the second court. About a mile S. of the town is the hospital of St. Cross, founded by Bishop Blois, for the residence and maintainance of thirteen poor men, and the relief of 100 indigent persons of good character. It was enlarged by Bishop Beaufort; but it now consists only of 10 residents, and 4 out-pensioners, with one chaplain and the master. Every traveller who knocks at the lodge and seeks relief, receives bread and beer. The architecture of the building is curious. The building called the king's house, intended by Charles II. as a palace, has been converted into barracks, which hold 3000 men. The ancient episcopal palace of Wolvesey castle still exists in ruins.

The trade of Winchester is inconsiderable. An ancient woolcombing manufactory still exists, and the silk manufacture has been lately introduced. Its trade is promoted by its vicinity to the sea, with which it has a direct communication by a navigable canal. The population of Winchester city and Soke Liberty, in 1821, was 1219 houses, 1432 families, 918 in trade, and total population 7739. The population of the city alone did not then exceed 5500 inhabitants. See the *Beauties of England and Wales*, vol. vi. p. 6, &c.

WINCHESTER, a flourishing post-town and seat of justice, Frederick county Virginia, situated on a branch of Opequan creek, 34 miles S.W. from Harper's Ferry, 71 miles N.W. by W. from W.C. and 150 miles N.N.W. from Richmond. N. Lat. 39° 10′ and Long. 1° 10′ W. from W. C. In June 1826, by an actual census, Winchester of Virginia contained—

Free white males - - - -	1302
females - - - -	1273
Free coloured - - - - - -	270
Slaves - - - - - - -	644
Total	3489

According to the Winchester Gazette, the village in 1826 contained the above population, 23 attorneys, eight physicians, 35 mercantile stores, three iron stores, two book stores, two printing offices, 12 taverns, four tanneries, one distillery, one pottery, one book-bindery, three silver-smiths, watch repairers and jeweller's shops, one clock and mathematical instrument maker, one rope maker, one tinner, one confectioner, one tobacconist, three brickmakers, one saddle tree maker, one upholsterer, three shoe stores, one wheel maker, two gunsmiths, one white smith, two cabinet maker's shops, with numerous weavers, saddlers, shoemakers, &c. &c.;

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* The dimensions of Winchester cathedral and other particulars have been given under CIVIL ARCHITECTURE.

seven houses of public worship completed for Presbyterians, Catholics, Episcopalians, Lutherans, Methodists, Baptists, and Quakers; a law school of eminence under Chancellor Tucker; an incorporated medical school, and an incorporated academy; the latter flourishing, and averaging 50 pupils; two female seminaries, with an average of 30 or 40 pupils each, with numerous private schools, and two banks. Population in 1830, about 4000.

DARBY.

WIND. See METEOROLOGY, Vol. XIII, p. 179-184, and PHYSICAL GEOGRAPHY, Vol. XV, p. 587. See also ANEMOMETER.

WINDHAM, southeastern county of Vermont, bounded W. by Bennington, N. by Windsor, E. by Connecticut river separating it from Cheshire county New Hampshire, and S. by Franklin county Massachusetts. Length from south to north 34, width 22, and area 748 square miles. Extending in Lat. from 42° 43′ to 44° 15′ N. and in Long. from 4° 1′ to 4° 34′ E. from W. C. Similar to Windsor county, the eastern part of Windsor slopes to the S.S.E. towards Connecticut river, and in that direction is chiefly drained by West river and its numerous confluent creeks. The western section is a mountain valley, along which winds southwardly the Moose branch of Deerfield river. More than a moiety of Windham is mountainous; much of the soil is productive, and in 1830 sustained an aggregate population of 28,746, or a distributive population of a fraction above 38 to the square mile.

WINDHAM, northeastern county of Connecticut, bounded by New London S., Tolland W., Worcester county in Massachusetts N., Providence county Rhode Island N.E, and Kent and Washington counties Rhode Island, southeast. Greatest length along Rhode Island line 35 miles, mean breadth 20, and area 700 square miles. Extending in Lat. from 41° 32′ to 42° N. and in Long. from 4° 40′ to 5° 12′ E. from W. C.

This county is nearly commensurate with the valleys of Quinebaug and Shetucket rivers, or the constituents of Thames river; general slope southwardly. Few, if any, portions of the earth present a more pleasing surface, and few in the United States a more agreeable mixture of natural and artificial scenery. By the census of 1830, this county contained 27,082, inhabitants, or a distributive population of upwards of 38½ to the square mile.

Brooklyn, the post-town and seat of justice of Windham, Connecticut, is situated on Blackwell's creek, 14 miles a little E. of N. from Norwich, and 30 miles E. of Hartford. N. Lat. 41° 47′, Long. 5° 4′ E. of W. C. DARBY.

WIND MILL. See MECHANICS, Vol. XII. Index.

WIND INSTRUMENTS. See ORGAN and ACOUSTICS.

WINDSOR, a borough of England in Berkshire, is situated on the side and at the base of a hill on the south side of the Thames, which is crossed by a bridge connecting it with Eton. The town is irregular, and consists of a principal street and several of a smaller size. The church is a neat, handsome Gothic building, erected not many years ago, and it has a good organ from St. George's chapel, presented by the late king. The guild-hall is a stately fabric, and supported by columns and arches of Portland stone, and in the area which they form the corn market is held. The free school is a neat building erected in 1706. A small but elegant theatre was built in 1805. Large barracks have been lately built capable of holding 750 infantry and 400 cavalry. The principal ornament of Windsor is its castle, the residence of the sovereigns of England. It owes its origin to William the Conqueror, who erected here a fortified mansion as a hunting seat, and it has been brought to its present state of grandeur by the labours of successive sovereigns. On the declivity of the hill on which the castle stands, there is a terrace 1870 feet long, and faced with a rampart of free stone. Near this walk is a gate into the Parks, which are enclosed by a brick wall, five miles in circuit. The castle consists of two courts, having a large round tower between them, the whole of the buildings covering 12 acres of land, and being defended by batteries and towers. The upper court is a spacious quadrangle, having a round tower on the west, the private apartments of the sovereign on the S. and E., and the state apartments, together with the St. George's hall and the chapel royal on the N. The keep is the residence of the governor. It has the form of an amphitheatre, and is ascended by a flight of steps. It contains the grand room or magazine for arms, ingeniously arranged and containing many pieces of ancient armour. The lower court, which is larger than the upper one, is divided into two parts by St. George's chapel, which is placed in the middle, and is a beautiful specimen of Gothic architecture. The houses of the dean and canon, &c. are on the north side of the court, and those of the poor knights of Windsor on the west side. The royal apartments are on the N. side of the court, and the entrances from the Upper Court, through a handsome vestibule, designed by Mr. James Wyatt. The first room, or the queen's guard chambers, contains many beautiful paintings, and a variety of warlike instruments. The queen's presence chamber contains paintings by the most celebrated masters, and its tapestry, made at Coblentz, was presented to Henry VIII. The ball room contains a large silver table: its tapestry represents the twelve months of the year, and its ceiling represents Charles Second giving freedom to Europe. In the queen's bed chamber, the state bed, erected by order of Queen Charlotte, is said to have cost £14,000. The queen's dressing room, hung with British tapestry, contains the closet in which is deposited the banner of France, annually presented on the 2d of August by the heir of the first Duke of Marlborough. The same closet contains the tea equipage of Queen Anne. The room of beauties contains fourteen portraits of the most celebrated beauties in the reign of Charles the

Second. The king's audience chamber, containing the throne, is enriched with Mr. West's seven historical paintings of events in the reign of Edward III. The king's presence chamber is adorned with several portraits. The king's guard chamber contains a great collection of warlike instruments fancifully arranged, and also the flag annually sent on the 18th June by the Duke of Wellington, in commemoration of the battle of Waterloo. The king's drawing room contains some beautiful paintings on the ceiling. St. George's hall, which is 108 feet long, is set apart for the illustrious order of the garter. The ascent to the throne is by five steps of marble. It is superbly decorated with allegorical paintings.

St. George's chapel was made one of the most elegant specimens of the florid Gothic by the munificence of George Third, who spent nearly £20,000 in embellishing it. The roof is elliptical, and is composed of stone, and the whole ceiling is ornamented with heraldic insignia, intermingled with the beautifully emblazoned arms of many sovereigns and knights of the garter. The screen is said to have cost £1500. The stall of the sovereign and those of the knights, exhibit a profusion of rich carving. The painting of the Last Supper, finely executed by West, adorns the altar. Several of the windows of the chapel are superbly painted. St. George's chapel is the burial place of many royal and illustrious persons, Edward IV, Henry VI, Henry VIII, and Charles I. At the east end of the chapel is a neat building erected by Henry VII. as a burial place. It is now the Royal Mausoleum, and contains the remains of George III. and Queen Charlotte, and of the Princess Charlotte and others.

On the south side of Windsor is Windsor Park, which is above 15 miles in circumference, and is stocked with deer. It is entered by a walk three miles long, called the long walk, flanked by double rows of trees. At the entrance to this park stands the Queen's Lodge, the gardens of which are elegant and extensive. Windsor sends two members to parliament, who are chosen by about 400 voters. The population of the borough, including Old Windsor, Windsor Castle, and Lower Court, in 1821, was 917 houses, 961 families, 411 do. in trade, and total number of inhabitants 5698.

WINE is obtained from the fermented juice of the grape; but the term is also applied to signify an agreeable spirituous liquor produced by fermentation from various fruits and vegetables, exclusive of grapes, such as currants, gooseberries, cherries, mulberries, apples, pears, and many others. In this article we shall confine our observations to wine produced from grapes.

The invention of wine is enveloped in great obscurity; and much fabulous tradition on the subject has been handed down to us. But we must refer this invention to very remote times. The first portion of the fruit of the vine, says Dr. Henderson, which had been pressed by accident or design, and allowed to remain a short time undisturbed, would be found to have assumed new and surprising properties; and repeated trials would soon prove the value of the discovery. By degrees, the method would be learned of preserving for constant use the beverage so obtained; and various processes would gradually be resorted to for enhancing its grateful qualities: the knowledge of the art would rapidly spread; and its simplicity would recommend its universal adoption.

This discovery of the latent virtue of the vine, and the invention of its manufacture into the beverage which forms the subject of this article, have, in different nations, been ascribed to different individuals. The Egyptians gave the honour of it to Osiris, the Latins to Saturn, and the Greeks to Bacchus, while various authors have respectively conferred the distinction on other persons, not certainly so celebrated as the fabulous individuals just named, but not the less likely to merit the honour in question. The investigation is very far from being important; the various persons who have been named as inventors were only, it is probable, the promoters of the manufacture under review. But we have higher authority on this subject than any that has yet been referred to. Whether wine was known before the flood we know not, as the sacred record is silent with regard to it; but we are distinctly informed that "Noah began to be an husbandman, and he planted a vineyard, and he drank of the wine." (*Genesis* ix. 20.) From the manner in which the subject is here introduced, it is not unlikely that the art of wine-making had been known to the antediluvians; but, however this may be, it is mentioned in almost every page of the sacred volume as quite commonly practised after the flood. "Corn and wine," which commodities seem to have been equally abundant, are mentioned in the Old Testament as expressive of the necessaries and comforts, if not the luxuries, of life.

But though vineyards were cultivated to so great a degree by the Israelites, and the manufacture of wine was so much extended, this beverage seems not to have been so common in other countries. Indeed the quantity produced elsewhere was for a long time very small. Except in Egypt and Greece, wine was seldom allowed either to virgins or matrons, or to young men. In Rome, most severe restrictions were laid on it for the first 200 years of that celebrated city. But about this period, that is 500 years before the Christian era, it began to be manufactured in greater abundance. When in ancient Italy the Romans had carried the cultivation of vineyards to the greatest extent to which they ever reached, their productiveness was incredible, exceeding that of modern vineyards by about a half. The varieties of the vine, known to the ancients, were very numerous, amounting to about fifty, some of which are described with sufficient minuteness to enable us to appreciate the relation in which they stand to our modern vines. Wine, however, was generally designated, not by the species of wine from which it was produced, but generally from the place where it was manufactured; thus we read of *Vinum Falernum*, *Massicum*, *Alba-*

num, *Chium*, *Rhodium*, *Maeonium*. Sometimes it obtained its name from its colour or age, as *vinum album*, *nigrum*, *rubrum*, *vetus*, *hornum*, *trimum*.

The juice of the grape, when subjected to chemical analysis, is found to consist of the following principal ingredients; namely, a considerable portion of water and sugar; extractive matter analogous to mucilage, some tannin, vegetable gelatin, accidulated tartrate of potash, tartrate of lime, phosphate of magnesia, muriate of soda, sulphate of potash, and a particular liquid substance, generally regarded as an elementary constituent on which the fermentative process depends. These, however, are not always found to exist in the same vine, and they vary considerably in different vines. But some of them, such as tartarous acid, sugar, extractive matter, and the liquid substance already referred to, are essentially necessary to fermentation: and it is by possessing these ingredients in proper proportions (for other fruits and vegetables possess them in some degree), that the grape is peculiarly fitted for making wine.

When the grapes are ripe, and the saccharine principle is developed, they are then pressed, and the juice thus obtained, or *must*, as it is called, is received into proper vessels, in which the fermentative process is meant to take place. "When the must is exposed to the temperature of 65° of Fahrenheit's scale, it speedily begins to ferment: small bubbles first collect on the top, and may be seen gradually issuing from the central parts of the liquor, and bringing up the husks, stones, and other grosser matters which it contains. As the disengagement of gas proceeds, a hissing noise is produced by the bursting of the bubbles; and a frothy crust or scum is formed by the viscid particles which they have carried to the surface. An increase of the temperature and bulk of the fermenting mass now takes place: the must loses its original consistency and its saccharine taste, acquiring a deeper colour and a vinous flavour, with an odour of spirit of wine, which becomes more perceptible as the process advances. At length these commotions of the fluid abate spontaneously; and, after a few hours rapid fermentation, the ebullition ceases altogether, the mass subsides to its former bulk, and the crust and solid particles which disturbed the transparency of the liquor, are precipitated to the bottom of the vessel." (Henderson's *History of Ancient and Modern Wines*, 3-4.)

In order to insure a regular and complete fermentation, it is necessary that the grapes should be all equally trodden, and that the vat which is to contain them, should be filled as speedily as possible; within twenty-four hours at farthest. Fermentation proceeds with incredible rapidity, insomuch that the juice, as it flows from the grape, will often work and ferment before it arrives at the vat, owing to the pressure and motion to which, when being carried from the vineyard, it has been subjected. The most favourable temperature, as already stated, is 65° of Fahrenheit. Below that degree, fermentation is languid; above, it is violent; and when very high or very low, it ceases altogether. When the process has commenced, however, the temperature quickly rises, even so high as 30° above the point in question. Another circumstance necessary to fermentation, is contact with the external air: without this, indeed, no fermentation can take place; but after the process has been established, such contact is not necessary. Finally, fermentation is brisk in proportion to the extent of the fermenting mass. In a cask it proceeds more slowly than in a vat: in short, the preference is to be given to large vessels. It may here be mentioned that when, from the deficiency or inactivity of the ingredients necessary to fermentation, that process does not go on successfully, means must be used to supply the defect. If, for example, the must is too thin and watery, and fermentation proceeds with difficulty, the objection may be removed by one of three ways: 1. By boiling the must and allowing the superabundant water to evaporate. 2. By merely throwing in a portion of must which has been thus thickened; or, 3. By adding a quantity of sugar, as is the common practice in cold climates where the grapes seldom reach their full maturity. In some places baked gypsum is used, in order to absorb the excess of humidity: in others, the grapes are partially dried before they are trodden. The addition of tartar accelerates fermentation, particularly if the grapes abound in the saccharine principle. The stalks of the grapes, when added to the mash, act as a powerful leaven, and augment the strength of the wine; but to the weaker sort, they are apt to communicate a harsh and austere flavour, owing to the tannin and extractive matter which they contain. In the case of Port, they are always used; while in the manufacture of the more delicate red wines of Bourdeaux, they are generally excluded. For the white wines of the same district, however, they are thought to be advantageous, rendering them less apt to spoil. Yet the wines of the Rhine, which are distinguished by their great durability, are not fermented with the stalks, and would probably not bear the addition. It is chiefly when the saccharine principle predominates that they contribute to the strength of the wine. The exact time required to complete fermentation varies, being dependant on the quality of the grapes and of the wine sought to be obtained. Weak wines require but a short time; the lighter wines, in truth, will not bear the vat longer than from twenty to thirty hours. If a brisk wine is wished, the contents of the vat must be drawn out into casks before the fermentation subsides. In general, the process may be regarded as terminated, when the saccharine flavour of the must has disappeared and the liquor has acquired a distinct vinous taste.

One of the principal results of the process of fermentation is the production of alcohol or spirit of wine, effected by the decomposition of the sugar and the separation of the mucilaginous extractive matter of the must in the form of lees. The alcohol may be separated from the wine in a pure state, by distillation; of which latter process, we may here remark, the ancients seem to have been entirely ignorant. Different kinds of wine yield very different quantities of alcohol: the strong wines of the south, particularly those of Spain and Languedoc, yield the most, namely, one-third of proof spirit.

In transferring the wine from the vat to the cask, it undergoes a new process, which renders it again turbid, and generates the phenomena that marked the former action. A portion of the sugar, though the taste of it has nearly disappeared, remains undecomposed; and this being acted upon by the mucilaginous extractive matter which still exists in solution, a disengagement of carbonic acid gas, and a fresh deposit of sediment, will be the result. These movements become by degrees less perceptible, but still there goes on an insensible fermentation, as it is called, which, particularly in the case of the stronger wines, will continue for many years; during which they become much ameliorated. A portion of the colouring matter and tartar is precipitated; the liquor loses its harshness, and the aroma and flavour that are peculiar to it become more apparent. These changes may be accelerated by various artificial methods, especially by the agitation of the lees, which always contain a quantity of fermentative matter, and by the assistance of heat. Hence the reason why certain strong and austere wines are so much improved and mellowed by being exported on the lees to a warm climate, while the lighter and more delicate wines are generally injured by being made to undergo a similar process, or even by the motion occasioned by the removal of them to any considerable distance.

The next step, when wine has attained a sufficient degree of maturity, is to free it from the lees by being racked, as it is termed, into a clean cask; and in order to prevent a renewal of fermentation, it is subjected to the operation of *sulphuring*. This process is generally performed by means of sulphur matches applied to the cask into which the wine is to be racked. Should the fermentation still continue, this application is renewed as often as may be necessary. Sometimes must, strongly impregnated with sulphurous acid gas, is added to the wine, which answers the same purpose as the other mode. After sulphuring, the greater proportion of wines require to be farther clarified, or *fined*, before they attain a due brightness. For this purpose various substances are used, which, by their chemical or mechanical action, unite with such materials as disturb the purity of the wine, and precipitate them to the bottom. The substances in general use are isinglass and the white of eggs, but as these, particularly in warm climates, are of a putrescent nature, gum arabic has been used instead of them. In Spain the white wines are sometimes clarified with fuller's earth. Powdered marble, gypsum, heated flints, beechwood chips, and a variety of other things are used for the same purpose. The quantity, however, of any of these substances used is very small: one ounce of isinglass, for example, is sufficient for a hundred gallons of wine. Brandy is sometimes mixed with wine; and different wines are as frequently mixed with each other: processes which require great attention and nicety.

With regard to the flavour and the colour of wines, we may state that neither of these two qualities are inherent to a very great degree in any kind of grapes, with a very few exceptions, but that they are artificially communicated to the wines by the manufacturer. These results are obtained in various ways, some of which continue a secret. Its flavour, however, is often generated by the application of bitter almonds, oak chips, orris root, wormwood, &c. while colour is the result of the use of logwood, Brazil wood, elder berry, oak chips, iron, &c. Both processes, to succeed, require to be managed with particular delicacy and skill.

We should have stated before this time that the vine, the source of the beverage of which we have been treating, does not thrive except between the 35th and the 58th degrees of north latitude, and that it is between these points that the best vineyards are found, and the richest wines are produced. In climates more northerly than that referred to, the grape seldom arrives at full maturity, and if wines are attempted to be made from it, they are weak, liable to sour, and destitute of the generous flavour which characterizes those produced in more favoured regions. South of the 35th degree, the saccharine matter predominates, and a complete decomposition cannot be effected. The vine improves when transplanted from a cold to a warm climate; but a contrary result takes place when carried from a southern to a northern latitude. The quality of the vine depends also much on the soil and the weather. Light and porous soils are the best: rich manure is prejudicial, and in some districts prohibited by a public decree. In a cold year, the grape never attains to proper maturity, and the wine produced from it is of a corresponding character. While much rain, fog, and high winds are injurious, a moderate degree of humidity is essential to the welfare of the vine. In climates where great drought prevails, the earth is formed into a hollow round the plant, to retain the rain which falls in spring. Undulating ground, with a good southern exposure, is the most favourable.

Such are a few general remarks on the vine, and on the nature of the process by which wine-making is conducted. There are some minute differences in the manufacture of the various species of wine, but of these we have not room, nor is it necessary, to give a particular account. The general principle which we have been analysing, may be regarded as the foundation of a process, of which the varieties are endless. There are also several subsidiary discussions connected with the manufacture under review which we cannot at present enter upon, and shall devote the remainder of this article to the topography of wines, or to a list of the principal wines which different countries in Europe produce.

France has been pronounced as more favourable than any other country for the growth of the vine. The cultivation of vineyards in that kingdom is extremely extensive: in 1808, for example, the quantity of land devoted to this purpose amounted to 3,988,974 acres; and the average annual produce for the preceding five years was 186,836,900 gallons; French wines, in consequence, are exported to almost every country in the world. Of these, the Bourdeaux, or claret wines, are the most celebrated, but from the limited nature of the soil favourable for cultivation, their quantity is small; not sufficient for the consumption of England alone. In 1808, the total quantity of claret of the first class was only 230 gallons, and of the second 425. Of the inferior kinds the produce was much more liberal; but the mixture of claret with inferior wines must indeed be very great to supply the universal demand for them. The best of the Bourdeaux wines are those of Margaux, Latour, and Lafite. The other wines of France, some of which can be obtained only in limited quantities, are all favourite and fashionable, namely, that of Burgundy, Champagne, Dauphiny, Lyonnais, Avignon, Languedoc, Provence. Spain and Portugal are, after France, the most celebrated wine countries, both of which are distinguished by a soil and exposure very favourable for the purpose. In Spain, Andalusia produces the best wines, particularly sherry; the next are those of Malaga, Alicant, and Fuencaral. In Majorca and Minorca also, vineyards abound, and wine-making is cultivated. The port wine from Portugal has long been famous in this country; it is produced in greatest abundance in Upper Douro, but other places afford it also, though to a limited extent. Portugal exports white wines as well as red. The wines of Madeira and the Canary Islands are well known. The Teneriffe wine cannot boast of the full body and rich flavour of the best growth of Madeira. Italy, once celebrated for the beverage under review, has lost that distinguished name, though the soil and climate are both propitious. Italian vineyards are managed in the most imperfect manner, and the best Italian wines hold a low rank, even in comparison with those of countries naturally less favourable for the production. "The Falernum and Caccubum, which inspired the muse of Horace, and warmed the heart of Cato, have disappeared from the soil; and the Rhæticum, which called for the eulogy of Virgil, as being second only to Falernum, would now be sought for in vain in the Veronese territory."—(*Henderson*, p. 235.) Similar observations are applicable to Sicily. The Neapolitan territories produce the best; that, for example, called Lacryma Christi. Greece and its islands, once so famous for their wines, now produce none but inferior sorts, and even these in small quantities; but now that political circumstances are more favourable, we hope for a correspondent change in this respect. The Morea was the original country of the Malvasia or Malmsey grape. Germany and Hungary have long been celebrated for their wines. The Rhine wines can vie with the very best made in France; and in various parts of Germany, wines of the first quality are produced. The excellence of the Tokay, and other kinds, show to what perfection the produce of the vine may be brought in Hungary, but as yet it has not been very assiduously or skilfully cultivated. In our colony at the Cape of Good Hope, we have introduced the growth of the vine; or rather it was introduced by the Dutch, ere we obtained that colony. The common Cape wine is weak and acescent; but Constantia and Cape hock are very rich and highly prized, but their value results as much from their rarity and costliness as from any other circumstance. The whole quantity of Constantia and hock annually made, does not exceed eighty-five pipes.—See Henderson's *History of Ancient and Modern Wines*, Lond. 1824, quarto, by far the best book on the subject; and our article FRANCE, Vol. IX. p. 421, 424, for more detailed information. (&.)

WIRE-DRAWING is the art of drawing out any of the ductile metals into long and regular threads of an uniform diameter, and of any size and shape.

The process by which this is effected is extremely simple, the apparatus employed consisting only of a *draw plate* and a *draw bench*. The *draw plate* is a thick plate of the finest steel, perforated with holes of various sizes from that of the largest to that of the smallest wire required. These holes are punched in the plate while hot by well pointed punches of German steel. Four heats are generally required, and at every heat a finer punch is employed, so as to make the hole taper or take a form slightly conical. The holes are made to differ from each other in diameter, by very imperceptible gradations.

The *draw bench* is a simple machine, consisting of a horizontal roller or axis turned by four vertical levers like a rolling press. A strong strap or chain is coiled round the roller, and at the end of the strap is a pair of pincers for taking hold of the end of the piece of metal to be drawn. The draw plate is then made to bear against two strong iron pins placed in the draw bench, and the piece of metal seized by the pincers is put into the hole in the plate immediately less in diameter than the piece of metal. By turning the levers, the pincers at the end of the strap pull the piece of metal through the hole in the draw plate, and thus lengthens it a certain quantity. It is then drawn through smaller and smaller holes till it is reduced to the proper degree of fineness, the wire being coiled up on the roller as it is drawn out.

In drawing thick wires, or pipes, or any other bodies which cannot be coiled up as they are drawn, the pincers are placed upon a movable frame which recedes from the draw plate.

In the wire mills in France the wire is not coiled round a barrel, but the pincers are attached to a lever which draws them backwards, and advances them forwards alternately, the pincers opening and quitting the wire when they advance, and shutting and seizing the wire when they begin to draw backwards. The operation is exactly like that of a man drawing a rope out of the water. When he has drawn it out a certain quantity he ceases to grasp it, and advances his hands to give a fresh pull. By this method of drawing wire, its surface is covered with pincer marks at the distance of two inches on the great wires, and five inches in the smaller wires.

Iron wire is principally used in the construction of cards and carding machinery, and so great is the demand for it, that Messrs. Minchel of Aigle in France manufacture annually a hundred thousand quintals of iron wire of 100 lbs. each. Most of it is consumed in France, and the rest exported to Spain, Portugal, Italy, and the Archipelago.

The drawing of wire out of the more ductile metals, sufficiently fine for the purpose of micrometers, has always been a desideratum in France. The French were celebrated for having produced the finest wire for such purposes; and we have been informed by the late James Watt, Esq. that the draw plates by which such wire was produced were lost during the revolution. The art, however, has been well supplied, and even greatly perfected, by a most ingenious process invented by the late Dr. Wollaston, the whole of whose paper* we lay before our readers, as it is incapable of abridgement.

"It is recorded by Muschenbroek," says he, "that an artist of Augsburg drew a wire of gold so slender that 500 feet of it weighed only *one* grain; but the method by which this was effected is not mentioned, and indeed it has been doubted whether it could really have been done. I shall, however, show that a wire of gold may without much difficulty be obtained finer than that spoken of by Muschenbroek, and that wire of platina may be drawn much more slender with the utmost facility.

Those who draw silver wire in large quantities for lace and embroidery, sometimes begin with a rod that is about 3 inches in diameter, and ultimately obtain wires that are as small as $\frac{1}{500}$dth of an inch in thickness. If in any stage of this process a rod of silver wire be taken, and a hole be drilled through it longitudinally, having its diameter $\frac{1}{10}$th part of that of the rod, and if a wire of pure gold be inserted so as to fill the hole, it is evident that by continuing to draw the rod the gold within it will be reduced in diameter exactly in the same proportion as the silver; so that if both be thus drawn out together till the diameter of the silver is $\frac{1}{500}$th of an inch, then that of the gold will be only $\frac{1}{5000}$; and of such wire *five hundred and fifty feet* would be requisite to make one grain.

For the purpose of removing the coating of silver which surrounds it, the wire must be steeped for a few minutes in warm nitrous acid, which dissolves the silver without danger of doing any injury to the gold. And though it might be difficult in this manner to preserve any considerable length of this wire, it is of little importance for any of those uses to which it is likely to be employed.

In my endeavours to make slender gold wire by the method above described, the difficulty of drilling the central hole in a metal so tough as fine silver, was greater than I had expected, and I was induced to try whether platina might not be substituted for the gold, as in that case its infusibility would allow me to coat it with silver without the necessity of drilling.

Having formed a cylindrical mould $\frac{1}{3}$ of an inch in diameter, I fixed in the centre of it a platina wire previously drawn to the $\frac{1}{100}$ of an inch, and then filled the mould with silver. When this rod was drawn to $\frac{1}{30}$, my platina was reduced to $\frac{1}{1000}$, and by successive reduction I obtained wires of $\frac{1}{3000}$ and $\frac{1}{5000}$ each excellent for applying to the eye-pieces of astronomical instruments, and perhaps as fine as can be useful for such purposes.

Since this has been the primary object that I had in view, I should have thought my time ill employed in pursuing farther the practical application of a method to which there seems no limit, except the imperfections of the metal employed. But as I found by trial the tenacity of these wires to be greater than was to be expected in proportion to their substance, that circumstance excited some doubts regarding the correctness of the estimate by which their diameter had been deduced. Other wires were consequently drawn with the utmost care, as to the quality and substance of the platina employed, and as to the proportional reduction of its diameter in the process of wire-drawing.

The extremity of a platina wire having been fused into a globule nearly $\frac{1}{4}$th of an inch in diameter, was next hammered out into a square rod, and then drawn again into a wire $\frac{1}{253}$ of an inch in diameter. One inch of this wire duly coated with silver was drawn till its length was extended to 182 inches, consequently the proportional diminution of the diameter of the platina will be expressed by the square root of 182, so that its measure had become $\frac{1}{253 \times 13{,}5} = \frac{1}{3425}$. The specific gravity of the coat of wire was assumed to be 10,5, and since the weight of 100 inches was 114 grains, its diameter was inferred to be $\frac{1}{42{,}8}$ of an inch, or just eighty times that of the platina contained.

With portions of the platina wire thus obtained, and successively reduced in diameter, I had an opportunity of repeating the trials of its tenacity with greater confidence in the justness of the estimate, and the results showed generally (though with some accidental exceptions), that the process of wire drawing, which is well known to improve the strength of metals within moderate limits, continued also to add something to the tenacity of platina even as far as $\frac{1}{18{,}000}$ of an inch, which supported $1\frac{1}{3}$ grain before it broke; but the wire on which these experiments were made began to be impaired by repetition of the operation; so that, although I afterwards obtained portions of it as small as $\frac{1}{30{,}000}$ of an inch in diameter, it was in many places interrupted, and I could place no reliance upon any trials of its tenacity.

There are some little circumstances in the management of these fine wires, which it may be of advantage to describe for the assistance of those who would apply them to any useful purpose. When the diameter is not less than $\frac{1}{2000}$ or $\frac{1}{3000}$ of an inch, the difficulty of seeing and applying them in short pieces is not considerable; but when their diameter is farther reduced, and their length as much as an inch or more, the slightest current of air is sufficient to defeat all attempts to lay hold of an object so difficult to see, and so impossible to feel; it is therefore necessary to retain a part of the silver coating at each extremity, which, at the same time that it assists in finding the end, also serves to stretch the wire with a certain moderate tension, and affords the means of attaching it in any required position.

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* *Philosophical Transactions*, 1813. p. 114—119.

The method which I have found most convenient is to bend a portion of the coated wire into the shape of the letter U, with small hooks at its upper extremities. In this form it will conveniently hang upon a wire of gold or of platina, with the lowest part immersed in nitrous acid, till the coating of silver is removed from that part. It may then, without difficulty, be lifted from its place, by one of the hooks alone, to any other situation, or suspended by it, with the other hook downwards, as the means of attaching a small chain, or other series of equal weights in trials of its tenacity."

WIRE Gause Lamp. See Mines.

WIRTEMBERG or Wurtemberg, a small kingdom of Europe in Germany, is bounded by Baden on the west and north, by Bavaria on the east and south, and a part of its southern frontier by the Lake of Constance. It contains about 7573 square miles, or 4,846,720 English statute acres. It is divided into the following circles:

Circles.	Area in English Statute Acres.	Population.
Neckar .	904,320	384,599
Iaxt .	1,318,400	318,999
Black Forest .	1,204,480	360,951
Danube .	1,468,160	360,849
Total .	4,895,360	1,425,398

Stuttgart the capital, forms a separate division by itself, but is included in the population returns for the circle of Neckar. The kingdom contains,

Cities having been walled .	130
Market towns . .	128
Parishes . . .	1115
Hamlets . . .	558
Farms . . .	2591
Castles, or seats of the nobility	269

The following are the principal towns with their population:

Stutgart . . .	22,000
Ulm . . .	15,600
Reutlingen . . .	8,831
Heilbron . . .	6,885
Tubingen . . .	6,554
Hall . . .	6,250
Esslingen . . .	5,591
Gmund . . .	5,570
Ludwigsburg . . .	5,226
Rothenburg . . .	5,147
Biderach . . .	4,451
Goppingen . . .	4,423
Kirkheim . . .	4,311
Schorndorf . . .	3,500
Calw . . .	3,400
Creilsheim . . .	3,100

The general aspect of the kingdom is mountainous and hilly. The range called the Alp or Alb in the northeast, and the Black Forest, which is a continuation of the Swiss Alps, rise to the height of about 2700 feet. The northeastern mountains are an insulated range of rocky hills, destitute of wood, and, to a certain degree, of verdure, and traverse the kingdom from Rotweil. The rest of the kingdom is covered with hills of moderate height, between which are extensive and beautiful valleys which enjoy a mild climate, and are highly fertile. The finest of these valleys are the valley of the Neckar, with its branches, and that of the Danube from Ulm to Tutlingen.

The principal rivers are the Danube and Neckar, the Enz, Muhr, the Kocker, the Iaxt, the Tauber, the Rems, the Erms, the Zober, the Shussen and the Argen; the two last of which flow into the Lake of Constance. The principal lakes are the Feder lake, about three miles long and three broad, the Lake of Laufen, and that of Pfaffen. The rivers and lakes contain salmon, trout, perch, carp, pike, eels, borvel and shad.

Wirtemberg contains of

Meadow land .	640,000	acres.
Arable land .	1,620,000	
Woods and forests .	1,520,000	
Vineyards .	61,000	

The rest being waste, are occupied with lakes, rivers, towns, &c. Agriculture is in a more advanced state than in other parts of Germany. Turnips, mangel-wurzel, and potatoes are extensively cultivated. Rape and poppies are raised for the manufacture of oil; and wheat, rye, oats, hemp and flax, are produced in abundance. The grain raised annually is about 23,000,000 bushels, and the export of corn exceeds the import by 80,000 quarters. The vineyards produce much wine, the best of which is the Neckar, but it is not of a good quality. The annual value is estimated at £400,000. Fruit of various kinds abound, and in some places there are complete woods of apple and pear trees. The Black Forest yields abundance of pine and fir wood, of which a great deal is exported.

The cattle, and particularly the cows, are of a good breed, and the butter and cheese are excellent. The breed of sheep and horses has been much improved. In 1820 the live stock was thus enumerated:

Horses . . .	80,870
Cows . . .	599,490
Sheep . . .	488,940
Swine . . .	114,200
Goats . . .	16,620
Asses . . .	1,008
Total . .	1,301,128

The mineral productions are iron, silver, copper, coal, and porcelain clay. The iron mines have been worked at Neuhausen, Fluorn, Neuenberg, Aalen, and Wasseralfingen. There are some springs at Hall, Sultz, Offenau, and Weisbach, from which 8000 tons of culinary salt are made annually, and a new spring at Kochendorf promises to yield a still more abundant supply.

The principal manufactures are those of linen and woollen fabrics. In the Black Forest every female spins in winter, and every peasant is a weaver. Damask table linen is made at Munsengen, and sail cloth is likewise made in the kingdom. A kind of fine lace is also made by the women. Cotton spinning and weaving are partially introduced in some places. The other articles of manufacture are glass, leather, paper, snuff, beer, hardware, cutlery, oil, pitch, tar and potearth. In the village of Mossingen, there are 280 stills for distilling brandy and whiskey. Wooden clocks are manufactured in great quantities.

Wirtemberg exports annually 18,000 oxen, 12,000 cows, 75,000 sheep, and 550,000 lbs. of wool, besides the articles of its manufactures above mentioned. Its imports are silk, cotton wool, East and West India productions, flax, hemp, hides and salt.

The revenue of the kingdom is about 11,000,000 guilders. The National Debt in 1817 was 30,000,000 guilders, or about £3,000,000. The expenditure in 1817 was under 10,000,000 guilders, of which 1,000,000 was appropriated to the king for his civil list, and 650,000 for the royal family.

The army is composed of 12,284 infantry, 3614 cavalry, and 2452 artillery.

Wirtemberg was made a kingdom in 1806. The government is a hereditary limited monarchy. There are two legislative chambers, the one containing the nobility and the protestant and Catholic prelates, and the other the deputies from the cities. All Christian sects enjoy equal political rights. See J. D. Memminger *Neueste Kunde von den Konigreiche Wurtemburg*.

WISBEACH, a market town of England, in the county of Cambridge, is situated on the river Ouse, which is crossed by an elegant stone bridge of one elliptical arch. The town consists of four principal streets well paved, cleaned and lighted. The church is spacious and singularly built, with a very beautiful tower. There are churches also for the quakers, anabaptists, baptists and methodists. The other public buildings are the shire hall, the custom-house, and the theatre, which is neat and commodious. There is here a free school, and two charity schools. Wisbeach carries on a considerable trade in corn, coals, timber and wine. It exports nearly 100,000 quarters of corn annually. The average of the exports and imports is about 40,000 tons annually. Population of the two parishes of St. Peter's and St. Mary's in 1821, was 1654 houses, 1774 families, 779 ditto engaged in trade, and the total number of inhabitants 7877.

WISTAR, CASPAR, was born in Philadelphia on the 13th of September 1761. His parents and ancestors, on both sides, were of the religious society of *Friends*. He was brought up in their principles, and received his classical education at a school established by charter from William Penn, in this city. He studied medicine under Dr. John Redman, a very respectable practitioner, with whom he remained upwards of three years. In 1782 he received the degree of Bachelor of Medicine in the University of Pennsylvania, having acquitted himself during his examination in an extraordinary manner. In the further prosecution of his studies, Dr. Wistar visited Europe in 1783. In June 1786, having written a thesis entitled *De Animo Demnisso*, he took his degree of Doctor in Medicine at the University of Edinburgh, and returned to his native city in January 1787. He now commenced practice with much reputation and success.

In the year 1792, Dr. Wistar became the associate of Dr. Shippen, after the latter had stood alone for thirty years in his efforts to create a permanent anatomical interest. This union grew out of the existence from 1789 to 1792 of two medical schools, the most recent of which had its origin from feelings generated by the revolutionary war. One of these schools, and the oldest, belonged to the college of Philadelphia, and the other to the University of the state of Pennsylvania. Dr. Shippen was professor of anatomy in both. In the year 1789 Dr. Wistar had been appointed professor of chemistry in the college; but before accepting he hesitated much, lest by his acquiescence, the consolidation of the two institutions, which he had much at heart, should be delayed or prevented. During his deliberations it occurred to him, that he could be much more efficient as a professor in procuring this union, than as a private individual: he therefore accepted the place of chemist, and in three years afterwards, had the satisfaction of seeing his wishes realized, and of reflecting that he himself had contributed largely, by his moderation and good management, to an arrangement which has since been so successful in developing the character and usefulness of the present institution.

Dr. Wistar, when quite a boy, had his prepossessions in favour of medicine awakened by the battle of Germantown. Restrained by his religious principles from joining his countrymen in the sanguinary defence of their rights, every fibre in his body then, as in the whole subsequent course of his life, vibrated to the calls of patriotism. He repaired to the scene of action, and in contributing his inexperienced attentions to the wounded soldier, was so much struck with the happy effects of the healing art, that from this moment he determined to study medicine. As a student he was distinguished by his zeal, his assiduity, and the promptitude and extent of his information.

In Edinburgh, then the chief resort of Americans, he became highly distinguished for the same qualities which he had manifested at home. The associate of Sir James M'Intosh, who has since become one of the leading members of the British senate—of Mr. Emmet, since then one of the most powerful and eminent members of the New York bar—of Dr. Jeffray, now Professor of Anatomy in the University of Glasgow, Dr. Wistar wielded with great power the gauntlet of debate, and obtained for himself the high honour among such competitors, of being made, for two successive years, President of the Royal Medical Society of Edinburgh. During his residence in Scotland, he seems to have attracted the marked attention of Dr. Cullen, for having presented certain written queries to Dr. C. on some medical subject connected with his theory; Dr. C. wrote a very polite note answering them, but stating at the same time, that it was not his habit to do such things, for if he should adopt it as a practice, it would subject him to endless trouble and inconvenience, in answering the letters of persons who cared but little for his opinions; but in the case of Wistar, it would always give him pleasure to solve his doubts and to add to his information.

Dr. Wistar's countenance, though not handsome, was benignant in the extreme; even strangers were struck with this. Many of his students remember the courteous and sprightly smile with which he entered and departed from his lecture room. Extreme suavity of deportment on every occasion of life, was his predominant mode of conduct. As a teacher, he allured by his gentleness and affability his students to flock around him on every occasion, and to ask him such questions as their want of information or misapprehension suggested. He was always on the alert to serve them in sickness, and to procure for them such places of profit and trust as his personal influence could controul, but invariably, I believe, on such occasions, with a conscientious regard to his knowledge of their characters and to their qualifications. This principle of impartial, but merciful justice, always guided him in his decisions on the claims of candidates for medical degrees. Willing to attribute every deficiency to embarrassment, he only became convinced that it was ignorance, when every proper mode of inquiry, repeatedly and leisurely tried, proved the incapacity of the candidate. In such cases his decisions were inflexible; as a conscientious man, having a public trust of first rate importance, he never consented for any one to take a recognised appointment in the profession, with a smaller share of knowledge than what he conceived necessary to the practice of medicine. From the goodness of his heart, I have no doubt that on many such occasions, he felt more for the candidate than the candidate felt for himself. His justice was evidently so impartial, and his goodness so conspicuous, that I have never heard the slightest breath of censure cast upon his proceeding, either by the fortunate or the unfortunate; on the contrary, their admiration of him had received a new impulse. In his social intercourse he possessed unusual tact in communicating pleasure. Though gifted with unusual strength and cultivation of intellect, and possessing varied and immense resources of conversation, he, on every occasion, seemed more desirous to hear than to be heard. From this turn of mind, his conversation abounded in a remarkable degree in questions; he culled information in that way from every source, and where he found a deficiency, he imparted abundantly of his own stock. Many young men, on first obtaining the pleasure of his acquaintance, were struck with this peculiarity—he inquired concerning the mountains, the rivers, the natural productions, the manners of the section of country to which they belonged, and listened with patient and obvious satisfaction to their answers. These interrogations not being expected, the person to whom they were addressed was not always prepared to answer them correctly. But if, through a desire of displaying more information than he actually possessed, the unfortunate individual answered like one who was well acquainted with the subject, another well-timed and pertinent question hinted to him that it was better for him to confess ignorance than to speak erroneously, for he was talking to one already acquainted with the subject of conversation. All this was done with so much delicacy, that pleasure instead of pain was excited, and I am sure, from my own feelings on returning home from such a discipline, that many persons must have resolved forthwith to make themselves well acquainted with objects so readily learned, and which, till then, it had never occurred to them, could become such interesting subjects of inquiry and of conversation. This happy tact made Dr. Wistar the charm of every circle. Unbounded in his hospitality, and fascinating in his manners, his house was the weekly resort of literary men of every description, both citizens and strangers: his company was courted equally by the young and the old, the gay and the sedate. It was very justly said of him, "if he addressed a promiscuous circle, he spoke like a man of the world, carefully avoiding every thing professional, technical, or in any way insulated; if an individual, he so suited his remarks to his taste and capacities, as to entice him into discourse, and draw from him his knowledge of the subject discussed."*

So deeply had his philanthropy affected his general deportment, that persons but just acquainted with him, were as fully persuaded of his disposition as those who had known him for years. In the sick room he was the ministering angel, compassionate, unwearied, prompt, and deeply-skilled; in bad cases never abandoning his patients, or ceasing to apply the resources of the art till life was extinct. In those terrible and unexpected accidents which sometimes come with overwhelming suddenness upon the practitioner of surgery, when even the stoutest and most collected hearts are paralyzed, Dr. Wistar, though on common occasions the most sensitive of mankind, found here all his faculties at their post. Whatever ingenuity could devise and skill combine, was rapidly executed. He was not one who in witnessing the immensity of a calamity, forgot the means by which it could be repaired or averted. In extending the benefits of his skill, the pecuniary recompense for it was the last of his thoughts. He practised, therefore, on the most disinterested principles, and being possessed of a good fortune with a lucrative professorship, his charges were proverbially moderate, and such as they were, very difficult to obtain. In this, however, he did a disservice to the profession, which I am sure he never intended. Inconsiderable charges from a man of his reputation and extent of business, in forming a sort of rule in the profession, of course affected deeply such as were only beginning, and such as had not the other resources which he wielded. Indeed, society itself is scarcely benefited by such a proceeding, for it is generally admitted, that the most able members of the profession have, for the most part, received the first impulse from the stimulus of necessity, encouraged with the hope of reward; but if the value of the latter be diminished much, it turns the minds of enterprising men from the pursuit, and renders those who are already in it, lukewarm; under which circumstances medicine loses much of its skill and respectability. No man, however, entertained higher notions of the value of professional services than Dr. Wistar, and it was this very lofty conception of them which prevented him from estimating their worth in pounds, shillings and pence.

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* Eulogium on Caspar Wistar, by Charles Caldwell, M.D.

Scrupulous and conscientious to an extreme in doing every thing for a patient which he thought could be of service, it is admitted that no other physician in the city encountered the same proportionate labour that he did. His efforts went much beyond those of a simple medical attendant. He felt the deepest personal interest for his patient, and not unfrequently afterwards his mind was filled with the strongest sentiments of friendship, founded principally on the benefits which it had been his happiness to extend. In difficult chronic cases he made numerous and protracted visits, and entered into the most minute and comprehensive investigation of them. It was on such occasions that the solace and sympathy of friendship were superadded to the balm of the healing art, and that impressions of devoted affection to him are to be found among numbers of individuals yet alive in Philadelphia, who, upon any one touching this string even gently, find it vibrate to the inmost recesses of their hearts, and in the crowd of recollections which the association excites, incapable of utterance, give vent to them in a flood of tears. To call this man good, is only to show the insufficiency of human language.

In a point of vast importance to the harmony of society and to the efficacy of Christian convictions, I consider him to have been a perfect model. The rule "Forgive us our trespasses as we forgive those who trespass against us," was most indelibly and productively imprinted on his mind. Endowed by nature with a sensibility to be compared only with that of a delicate, youthful, and highly-refined female, it is not to be expected but that in our profession he received some rude shocks, enough so indeed to stagger a mind more coarsely organized than his own. Incapable of injustice and of rancour himself, when the first burst of indignation was over, which he owed to human nature, then came the sunshine of a calm and undisturbed conscience. Judging other men by himself, he trusted that there was some mistake, that it had not been intended, that the person had been betrayed into extremities by a vehement and uncontrollable disposition. If, however, a perseverance in injury proved that it was a deliberate and unrepented act of malice, no harsh retort came from his lips; they were closed forever upon the personal demerits of the individual, while he did ample justice to the merits, professional, or otherwise, which the person may have possessed. From this Christian charity, even many of his most intimate friends declare that they never heard him depart, nor utter an unkind word against such as had flagrantly injured him. The sense of the injustice, if retained in his memory, to the eyes of society was buried in oblivion. But if in his own justification it became necessary to expose the transaction, he did it in the least offensive terms, and in such a manner as to express regret rather than resentment. Repeatedly have I witnessed this trait in his character.

The talents which had borne him up to this period of life, were now applied with renewed vigour. Determined on discharging his duties to the best of his power, no pains, no expense, were spared. Well experienced in the best mode of instruction, in what was most useful to be learned, he sustained, in the maturity of his reputation, the high opinion that had been formed of him. As a teacher of anatomy, differing in many respects from his illustrious predecessor, his elocution was equally popular. Able, zealous, accomplished, with a great fund of solid information, with manners universally popular, his students who travelled abroad said of him, as has been said of Dr. Shippen, that no man they had met with was his superior, and very few his equals. His style of speaking was of that earnest and fluent kind, which, abounding in important truths, without restricting itself to the formal rules of oratory, commanded irresistibly the attention. It was not so much the speaker that spoke as the subject which he was discussing; the absorbing interest was in the latter.

The last year of Dr. Wistar's mortal career was marked by an unusual concourse of students, and by a series of lectures, in which he even exceeded his former reputation. In his fifty-eighth year, animated by a new and improved lecture room, but in an impaired state of health, his excessive fondness for the duties of the chair still stimulated him to advance in the noble career. In this zenith of popularity and of public confidence, he was assailed with the malady destined by Providence to close his labours. He died, universally lamented, on the 22d of January 1818.—*Abridged and compiled from* Tilghman's *Eulogy*, Dr. Horner's *Introductory Lecture, and other sources, by* ROBERTS VAUX.

WITCHCRAFT may be defined the pretended or supposed possession of supernatural power, in consequence of an alleged compact made with the devil; the object of which was either to procure advantages to the persons thus endowed, or their friends, or to do evil to their enemies. This compact was not reckoned valid until it had been written out with blood taken from a vein of the person or persons, who thus resigned their life to the service of the evil being in question. An individual who in this way became a witch, gave up to him soul and body; and at death he necessarily went to the regions of horror and despair. The devil, on his side, guaranteed that the persons who thus sold themselves to him should want for nothing they desired in this world; that they should be avenged upon their enemies; that they should have the privilege of inflicting disease on whomsoever they wished; and that, in short, their power of doing evil should be very great, if not unlimited. To accomplish this purpose, a familiar spirit or gnome was given them by Satan, which was ready to attend them at a call, and was entirely subservient to their will. Any of the lower animals, such as cows, horses, &c. or any of the human species that had been *witched* could never thrive: they gradually withered and died, or dragged out a weary life with many marks of an untoward unearthly character about them. The witches could assume any shape they chose, which was generally supposed to be that of a hare; and they could transport themselves through the air with unspeakable rapidity, on a broom-stick, or nut-shell, or any such article, for any purpose, particularly to attend meetings of witches, at which the devil himself always presided.

That witches, such as we have described them, that is, persons supposed to be possessed of supernatural endowments, in consequence of a compact make with Satan, or who pretended to such endowments, have existed, is an opinion that has more or less obtained in every age. The origin of such an opinion, which all intelligent men now declare unfounded, it is somewhat difficult to trace. As this opinion has been found to prevail most among ignorant people, and in unenlightened countries, it is not improbable that it originated in superstition, in a sense of our own weakness and insecurity, in our profound reverence for the Deity, and in the vague and undefined notions we possess relative to the power and influence which God has granted to that " roaring lion that goes about seeking whom he may devour." Before the Christian era, however, and at that time, that arch enemy of mankind was, undoubtedly for wise purposes, allowed powers, and held a visible intercourse with our species, which have long been denied him. In various parts of the sacred volume we have evidence of this. Compare Exod. xxii. 18; Levit. xix. 20, 31; Acts viii. 9; xvi. 16; and Galat. v. 20. That witchcraft, however, ever existed in any degree, or in any sense, has been doubted or denied by the most eminent expounders of Scripture. On this important subject we cannot enter at present. Nor is it necessary; for though we allow, (what by no means must be taken for granted,) that " the prince of the power of this world" may, for benevolent purposes, have had these privileges given him, either under the former dispensation, or at the Christian era, such privileges, like many other peculiarities of these remote times, have now been entirely annulled. The modern witch, besides, is a considerably different personage from any we read of in the sacred volume. The ancient witches seem to have been somewhat similar to our modern fortune-tellers; for " they made great gain by divination;" and the idea of the immense transportability spoken of above, is never once alluded to in Scripture.

The belief in witchcraft, as already hinted, has always disappeared according to the advancement in any country of literature and liberal knowledge. There is not at this day, it may with perfect safety be affirmed, a single person of intelligence by whom the very idea is not ridiculed. If in any quarter it yet obtains, it is merely among the lowest orders, among whom the idea of ghosts, and hobgoblins, and other cognate superstitions still abound. In a a few years, even in the most remote and ignorant parts of this country, the belief in witchcraft, like that in the second sight, will be entirely obliterated.

There is, besides, something very absurd and contradictory in the idea entertained in many countries on this subject. At the time of the reformation, the Pope and the heads of the Romish church asserted or believed that all protestants were witches, that they associated with demons, and caused infinite mischief to man and beast by means of their hellish sorceries. The German protestants, and the Waldenses in a different part of Europe, were proceeded against, and many of them burnt as witches, in consequence of bulls from the pope founded on this belief. Nor is this the only absurdity in regard to this superstition. It was universally held that a witch could glide through a key-hole, and fly a thousand miles between midnight and sunrise, yet, in opposition to this opinion, witches were forced to languish in a dungeon, and to submit to be laid on a pile of faggots, or to other such indignities and punishments.

We have already alluded to the frivolous nature of the actions or proceedings by which witches were supposed to be characterized. On this subject nothing farther requires to be said. And we now proceed to show, in conclusion, that the mode of detecting and of trying these unhappy persons, (for witchcraft was both by the law of Moses, and by the laws of this and almost every other country treated as a capital crime,) was not less frivolous and absurd than any other circumstances connected with them. One woman was condemned for a witch on the following evidence: A witness swore, that coming from the ale-house at night, he looked in at her window, and saw her take two imps out of her basket, one black and the other white; the white imp was in fact nothing but a lock of wool which the poor woman was going to spin, and the black imp its shadow! If a person suspected of witchcraft could shed more than three tears, which three were confined to her left eye, she, (for witches were generally of that gender,) was at once declared guilty. If a person so suspected squinted, her doom was sealed, as squinting was believed to arise from the horrid visions and apparitions of evil spirits. If she did not confess, the same result followed, for this taciturnity on the part of the victim was ascribed to the devil. Witches, it was believed, could not sink in water: therefore, when thrown into this element, if they swam, they were taken out and burned as guilty; if they sunk, they were certainly regarded as innocent, but drowning was, notwithstanding, often the alternative. Another was brought to the stake, because she had been convicted of riding upon her own daughter transformed into a pony, and shod by the devil. To have any mark on the face or body was a sure token of witchcraft. But there is no end of such examples. Those quoted show to what a lamentable extent superstition abounded till lately; and how little the nature of evidence was regarded, or rather how false witness, which favoured the superstitious credulity of the age, was not only received, but courted.

But it may be said, that persons accused of witchcraft have confessed the truth of the accusation, and admitted having entered into a compact with the devil. The truth is,—and this fact ought probably to have been previously mentioned,—many persons of an idle and abandoned life were accustomed to feign witchcraft, and to make a boast of their pretended art, in order to intimidate the superstitious, and to extort from them whatever they desired. Deceit, when carried on for a certain time, becomes, as it were, a second nature; and on this principle abandoned persons, who at first merely counterfeited witchcraft, at length, either from habit or obstinacy, or both, were willing, in the face of any danger, to make that appear as real which was only counterfeit. Besides, when they had supported the imposture for many years, there was sufficient evidence to convict them, whatever their ultimate confessions may have been. Such persons were so far gone in villainy, that they not unfrequently hawked about with them poison, in order to gratify their customers in their darkest purposes of avarice or revenge.

The last execution of a witch took place in Sutherlandshire so recently as the year 1722. The statutes against witchcraft, both Scottish and English, were repealed in 1735; which gave such offence to a respectable sect of Christians in Scotland, that, in their annual confession of personal and national sins, they complained against "the penal statutes against witches having been repealed by parliament, *contrary to the express law of God.*"

See *Dæmonologie*, by King James VI.;* Sinclair's *Satan's Invisible World Discovered;* Baxter's *World of Spirits; Praefatory Notice* to Law's *Memorialls*, by Sharp; Reginald's Scott's *Discovery of Witchcraft;* Brand's *Popular Antiquities*, edited by Ellis, 1813; and *The Quarterly Review*, vol. xi. art. I.

(T. M.)

WOAD. See FRANCE, Vol. IX. p. 413; see also DYEING, Vol. VIII.

WOLF. See MAMMALIA, *Index*.

WOLSEY, or WULCEY, THOMAS, a celebrated Cardinal, was born at Ipswich in 1471, and was educated at Magdalen College, Oxford. Having been appointed master of the school dependent on the college, he had under his care three sons of the Marquis of Dorset, who presented him in 1500 to the rectory of Lymington. He became domestic chaplain to the Archbishop of Canterbury, and afterwards chaplain to the House of Henry VII. In this situation he enjoyed the confidence of the king, who appointed him Dean of Lincoln. Upon the death of his royal master, he was recommended by the Bishop of Winchester to Henry VIII. whose favour he conciliated to such a degree, that he became his sole adviser. He became a privy councillor in 1510, then Chancellor of the Garter, and in 1513 he was promoted to the sees of Tournay and Lincoln, and to that of York in 1514. He got possession on easy leases of the revenues of Bath, Worcester and Hereford, bishoprics which were held by non-resident Italians. He held in commendam the abbey of St. Albans, and other church preferments, and he was even permitted to hold the sees of Durham and Winchester along with that of York. When the pope perceived the influence which he had acquired over the king, he raised him in 1515 to the rank of a cardinal, and appointed him legate *a latere*, by which he acquired a legal pre-eminence over the Archbishop of Canterbury. Charles V. Frederick I. and the pope purchased his influence with his sovereign by pensions, and Charles not only settled upon him the revenues of two Spanish bishoprics, but held out to him the hopes of the Papal crown.

Under the pretence of exacting respect for religion, he endeavoured to throw round him all the splendour which his wealth and influence could command. Among his train of 800 servants were many knights and gentlemen, and some of the nobility sent their children into his family as a place of education, and allowed them even to bear offices as his servants. The richness of his equipage and grandeur, the costliness of his liveries, his apparel of silk and gold, and the splendid trappings of his horses, kept pace with the princely character of his establishment. A tall and handsome priest carried before him a pillar of silver, surmounted with a cross, and another priest, equally handsome, bore before him the cross of York, even in the diocese of Canterbury. When Warham, Archbishop of Canterbury, resigned the chancellorship, the great seal was immediately delivered to Wolsey.

But the ambition and the follies of the cardinal were not unbalanced. A strict administration of justice took place while he held his high office. No chancellor, as Hume observes, "ever discovered greater impartiality in his decisions, deeper penetration of judgment, or more enlarged knowledge of law and equity." The very tranquillity of the kingdom has been ascribed to the exact administration of justice, brought about by means of his exertions. Science and literature found in him a ready and a generous patron; and by his private bounty, as well as by the important institutions which he founded, he gave encouragement to every branch of knowledge. He not only founded several lectures at Oxford, but he erected the college of Christ church, and established a collegiate school in his native town.

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* The very important and conscientious motives to which this production is owing, may be learned from the words of the royal author, as follows: "The fearefull abounding at this time in this countrey of these detestable slaues of the Diuel, the witches or enchanters, hath mooved mee (beloued reader) to dispatch in post this following treatise of mine, not in any wise (as I protest) to serue for a shew of my learning and ingine, but onely (moued of conscience) to preasse threby, so farre as I can, to resolue the doubting hearts of many; both that such assaults of Satan are most certainely practised, and that the instruments thereof merits most seuerely to be punished."

The political conduct of Wolsey, and the events which led to his fate, have already been fully detailed in our article England, Vol. VIII. p. 477. He died of dysentery in Leicester abbey on the 20th November 1530, in the 68th year of his age. A short time before he expired, he addressed the following words to Sir William Kingston, constable of the Tower, who had him in custody. "I have often kneeled before the king, sometimes three hours together, to persuade him from his will and appetite, but could not prevail: *had I but served God as diligently as I have served the king, he would not have given me over in my grey hairs.*" See the lives of Wolsey by Cavendish, Fiddes, Galt, and an excellent one in the library of Useful Knowledge.

WOLVERHAMPTON, a large town of England, in Staffordshire, is situated on a gentle declivity on the Birmingham canal. Although the streets are irregular, yet the town is well built, and contains many excellent houses, chiefly of brick. It has two churches, the Collegiate church of St. Peter's, and that of St. John's. The former is situated on a rising ground to the east of the town, and consists of a lofty naive, two aisles, and a chancel, with a fine Gothic embattled tower. The pulpit is of stone, and the church contains some good monuments, and a curious stone font. In the church yard is a round column twenty feet high, and covered with rude sculpture. The church of St. John is a neat wooden building, completed in 1776. Besides three chapels on the establishment, there are numerous meeting-houses for dissenters. The other public buildings are a free school, which is a handsome brick building, two charity schools for fifty boys and forty girls, an hospital for a priest and six old women, and a work house.

The manufactures of Wolverhampton consist principally of locks, keys, and other hardware articles. A great part of the ironmongery is made by the farmers in the vicinity, who have forges, where they work when they are not employed in agriculture. Both the men and women are regularly brought up to the business. The celebrated Antonio de Dominis, archbishop of Spalatro, and the discoverer of the cause of the rainbow, was made dean and first prebendary of Wolverhampton by James I. The population of the town, and a small part of the parish in 1821 was 3338 houses, 4208 families, 14,047 in trade, and total number of inhabitants 18,380.

WOOD Engraving, &c. See Engraving.

WOOD, county of Virginia, bounded N.E. by Tyler and Harrison counties, E. by Lewis, S.E. by Kenhawa county, S.W. by Mason, and by the Ohio river, which separates it from Meigo and Athens counties of Ohio on the W., and from Washington county of Ohio N. Length from S.W. to N.E. 36 miles, mean breadth 30 and area 1080; extending in Lat. from 38° 50′ to 39° 22′, and in Long. from 3° 52′ to 4° 10′ W. from W. C. The far greater part of Wood is included in the valley of Little Kenhawa, with a northwestern declivity. Surface excessively broken, with, however, much good soil. Chief town Parkersburgh. By the post-office list of 1831, there were post-offices at Belleville, Jacksonville, Parkersburgh, Pennsborough and Schultz's Range. Population in 1820, 5860; in 1830, 6429. Darby.

WOODBRIDGE, a town of England in Suffolk, is situated on the navigable river Deben. The principal streets, one of which is nearly a mile long, are clean, well paved, and contain many good houses. In the market-place is the ancient church, and beneath the court-house is the market-hall. The church is a handsome Gothic structure, built with black flints, and has a tower 180 feet high, which is a conspicuous sea mark. There are also meeting-houses for the Independents, Quakers, Methodists, and Baptists, besides a grammar school and two almshouses. From its situation on the Deben, Woodbridge enjoys an extensive coasting trade, and great quantities of corn, cheese and butter are shipped from its quay. About 44,000 quarters of grain, and 9220 sacks of flour were shipped to London in 1810. Population of the town and parish in 1821, 640 houses, 880 families, 556 in trade, &c. and total population 4060.

WOODFORD, county of Kentucky, bounded by Franklin N.W., Scott N.E., Lafayette E., Jessamine S.E. and Kentucky river, separating it from Mercer, S.W., and Anderson W. Length from S. to N. 22, mean breadth 7, and area 154 square miles; extending in Lat. from 38° 53′ to 39° 11′, and in Long. from 7° 36′ to 7° 50′ W. from W. C. The declivity of this narrow county is westward, towards Kentucky river. The soil is generally excellent. Chief town, Versailles. By the post-office list of 1830, there were post-offices at Mortonsville, Rees's Cross-Roads and Versailles. Population 1820, 12,207, in 1830, 12,294. Darby.

WOODSTOCK, a burgh of England, in the county of Oxford, is situated on a brook running into the Isis, and consists of several irregular streets, the houses of which are well built. The church is a handsome structure, with a neat tower. The town-hall is a neat building. Near the church is a good grammar school, and near the entrance to the town from Oxford is a row of almshouses, endowed in 1793 by Caroline, Duchess of Marlborough. The manufactures of this place are articles in polished steel and gloves. The former were made from the old nails of horses' shoes, and take a remarkable polish. The manufacture of leather into gloves and other articles of dress is very flourishing. About 500 dozen pair of gloves are made weekly; and it is supposed that 100 men and 1500 women and girls are employed in the various branches of the manufacture. Woodstock returns two members to parliament. A description of Blenheim house, in the immediate vicinity of Woodstock, has been given in Civil Architecture, Vol. VI. p. 500, and a representation of it in Plate

CLXXIX. Population of the burgh and parish in 1821, 246 houses, 318 families, 275 do. in trade, and total population 1455.

WOOL. See France, *Index*, and Shawl Goat.

WOOLLEN Manufacture. See Cloth Manufacture; also England, Vol. VIII. p. 572, where we have given a detailed history of the Woollen Manufactures, and France, *Index*.

WOOLWICH, a town of England, in Kent, is situated on the south bank of the Thames, and consists of several irregular streets, the houses of which are well built. The church dedicated to Mary Magdalene is a spacious brick building, with a plain square tower.

Woolwich is chiefly celebrated for its dock-yard, arsenal, laboratory, and military academy. The dock-yard extends about five furlongs along the river, and is about a furlong wide. It contains two dry docks, several slips, three mast ponds, a smith's shop, forges worked by steam for making anchors, a model loft, store houses, and sheds for timber. During the last war the number of artificers employed in the dock-yard was 2000, but it is now not much more than half that number.

The arsenal occupies nearly 60 acres, and contains different piles of brick building, the oldest of which are the foundry and the old military academy. In the foundry are three furnaces, the largest of which will melt about seventeen tons of metal at once, and a machine for boring cannon. (See Boring Machine.) In another building there are two boring machines and various workshops for finishing off the ordnance after they have been proved. The arsenal contains an immense store of cannon arranged in tiers of great length, with mortars, howitzers, carronades, and all the apparatus of the field and battering train, besides gun-carriages and military wagons.

Near the foundry is the laboratory, where barbs, carcasses, grenades, &c. are charged, and rockets, cartridges, and fire-works made up for the army and navy. In the arsenal there has been erected a planing machine driven by a steam engine, of which we have given a description and drawings in our article Planing Machine. The number of artificers employed in the arsenal is about 3000, exclusive of about 900 convicts.

The royal military academy has been already described in our article Academy. The building, designed by Wyatt, is of the castellated form, and consists of a centre and two wings united by corridors. The centre is a quadrangle, with octagonal towers at the angles, and contains the academy rooms. The wings contain the apartments of the cadets and officers. The building, which is of brick, is 600 feet long. The hall is elegant. The whole building cost £150,000.

The artillery barracks is a very extensive building, having its principal front nearly 1200 feet long. It is composed of six ranges of brick buildings united by an ornamental centre of stone, and by other four lower buildings which occupy the spaces between each range. These latter buildings, as well as the ornamental centre, are built of stone, with doric colonnades. They contain a library and reading-room, a chapel, a mess-room, and a guard-room. At a little distance is a new riding school built of brick, on the model of an ancient temple. It is about 150 feet long and 63 broad. Between the royal arsenal and the dock-yard is an extensive building about 400 yards long, including a rope-work where cables of all dimensions are manufactured. The other buildings are an ordnance hospital, a veterinary hospital, barracks, and a handsome hospital for the fourth division of marines. The most conspicuous of the detached buildings is a pagoda 115 feet in diameter, which was brought to Woolwich from Carlton-House Gardens, where it was used as a banqueting room for the sovereigns after the battle of Waterloo. It is now used as a repository for models. The population of the town of Woolwich in 1821, was 2520 houses, 4293 families, 1652 ditto in trade, males 7606, females 9402, and total population 17,008.

WOOTZ. See Steel.

WORCESTER, a borough of England and the capital of Worcestershire, is situated in a fine vale on the banks of the Severn, over which there is a handsome stone bridge of five arches, built in 1780. The principal streets are the Firegate street, the High street, the Broad street, and Bridge street, which are regular and beautiful, and contain many handsome houses. The cathedral is a fine specimen of the simple Gothic, and is remarkable for its height and extent, as well as for the lightness of its architecture. It is 514 feet long, 78 broad, 68 high, with an ornamented and elegantly embattled tower, which rises from the centre of the cross aisle to the height of 200 feet. The interior is distinguished by the regularity and beauty of its architecture, and by the numerous monuments which it contains. The choir is particularly fine, and the stalls elegantly carved. The east window over the altar, and the octagonal stone pulpit, with emblematic sculpture, deserve notice. The organ has a fine tone and excels all others in its trumpet stop. In going up to the altar the spectator is arrested by an altar tomb in the centre and near the east end, which is the tomb of King John, surmounted with his effigy, and bearing the almost effaced inscription of *Johannes Rex Angliae*. In 1797, the stone coffin was taken up, and the royal corpse found in it. On the south side of the altar is Prince Arthur's sepulchral chapel, one of the most elaborate parts of the cathedral. The cloisters now inhabited by the dignitaries of the cathedral are 125 feet long and 16 wide. On the south side of the cathedral is the college green, on the east side of which is a gate called Edgar's tower, having on the outer front statues of that king and his two queens. The bishop's palace stands on the banks of the Severn, in a commanding situation. Parts of the ditch of the ancient castle are yet to be traced.

There are seven parish churches within the walls, and two without. The most important are St. Michael's, St. Andrew's, and All-Saints. St. Andrew's is very beautiful and has a lofty spire. All-Saints church is a handsome modern edifice.

There are also meeting houses for catholics and other dissenters.

The guildhall, finished in 1723, is a handsome brick building with stone corners. The chief entrance, which is by semicircular steps, is adorned with rich composite columns, with statues of the two Charles' in niches, and one of Queen Anne. The county jail, enlarged in 1775, is on the Howard plan. It has two large court yards, and a centre house for the jailor. The city jail was once part of a house of Franciscan friars. The other buildings are the city bridewell, the infirmary, and various hospitals, alms-houses, and charity-schools, together with a Lancasterian school. The market place is a handsome building with a fine stone front, with excellent interior arrangements. The high market is a large quadrangle, having on three sides lofty ranges of large and regular warehouses. The theatre is a neat building.

The principal manufacture is that of gloves, which is carried on upon a great scale both for home consumption and exportation. The annual returns are estimated at £100,000, and the persons employed at 500 women, besides the men. The royal porcelain works carried on by Messrs. Flight, Barr, and Barr, have produced from British materials the most beautiful and highly finished specimens of the art, which completely equal if they do not surpass the best foreign productions. Population of the city of Worcester in 1821, 3037 houses, 3786 families, 3247 ditto in trade, and total number of inhabitants 17,023. See Chamber's *History, &c. of Worcester*, 1818, and the *Beauties of England and Wales*, vol. xv. part i. p. 46—162.

WORCESTER, county of Maryland, the extreme southeastern of that state, bounded by Accoma county of Virginia S., Somerset county in Maryland W., Sussex county in Delaware N., and by the Atlantic ocean E. Length from S. to N. 30 miles, mean width, including the islands, 25, but excluding the islands 20, the area with that of the islands about 700 square miles. Most maps extend this county, and of course the state of Maryland, to N. Lat. 58°; this is however a mistake, the real southern boundary is not along a curve of latitude, but is on the Atlantic ocean about 3 minutes, and on Pocomoke bay, upwards of 1 minute, N. of Lat. 38°. The northern boundary is on N. Lat. 38° 28′, and the country lies between Long. 1° 24′ and 1° 55′ E. from W. C. The declivity is to the S.W., and drained in that direction by Pocomoke river, which is discharged into Chesapeake bay. The surface is level and soil sandy. Chief town, Snowhill. By the post-office list of 1831, there were post-offices at Berlin, Newark, Newtown, Poplartown, Saint Martin's, Sandy Hill and Snow Hill. Population in 1820, 17,421; in 1830, 18,271.

WORCESTER, great central county of Massachusetts, bounded by Chelshire county of New Hampshire N.W., Hillsborough county of New Hampshire N., Middlesex county of Massachusetts N.E. and E., Norfolk county of Massachusetts S.E., and Providence county of Rhode Island, and Windham of Connecticut N. This large county crosses the state from N. Lat. 42° 1′ to 42° 42′, and extends in Long. from 4° 44′ to 5° 30′, E. from W. C. The length a little exceeds 47 miles, from south to north. The eastern and western outlines are very irregular, of consequence the mean breadth difficult to determine, but is about 35 miles, and the area about 1650 square miles.

Worcester county of Massachusetts, is a true table land traversed nearly along the middle, and from south to north, by a chain of real though not very elevated mountains. From this central chain Chickapee river flows south-westward, Miller's river north-west by west. The higher branch of Souhegan north, the north-eastern section, is drained to the north-east by the various branches of Nashua river. Blackstone or the higher constituents of Pawtucket, bears its waters south-eastward, towards Narragansett bay; and finally, from the south-western section flow the superior confluents of Quinebaug, or the north-eastern constituents of Thames river. The superior elevation of the central plateau is around the town of Worcester, the county seat. For relative elevation of this county with the Atlantic coast near Boston, and of Connecticut river at the mouth of Westfield river, see Table XV. page 270, art. U. S. in this volume.

Worcester exceeds Rhode Island in superficial extent, and in 1830, the former sustained 84,355 inhabitants, or a small fraction above 51 to the square mile. In 1831, this county contained 67 post-offices. Worcester, the seat of justice of this county, stands on the comparatively elevated table land from which issue the higher fountains of Blackstone river, and from which a navigable canal is in progress to unite with Narragansett bay at Providence. This is considered as amongst the finest inland towns of New England, and is especially remarkable for extensive business in printing books. It possesses numerous other manufactories, one or more learned societies, several places of public worship, and in 1830 a population of 4173. N. Lat. 42° 16′, Long. 5° 12′ E. from W. C. Elevation of the cultivated land in the vicinity exceeding 550 feet above the Atlantic level. Distant 39 miles a little S. of W. from Boston, and 394 miles by post-road N. from W. C. DARBY.

WORCESTERSHIRE, an inland county of England, is bounded on the south by Gloucestershire, on the east by Warwickshire, on the west by Staffordshire, on the north-west by Shropshire, and on the southwest by Herfordshire, which separate it from Wales.

It is about 30 miles long and 25 broad, and contains 729 square statute miles, and 466,560 English statute acres. It is the thirty-fourth county in point of size. Its rental is £516,203 and £46,901 of tithes, the annual value of a square mile being £772. It is divided into five hundreds, and contains one city, eleven market towns, about 400 villages and hamlets, and 152 parishes, including one bishopric and three burghs.

The general aspect of Worcestershire is that of a rich and beautiful plain, covered with gentle undulations, which disappear when seen from an eminence. The elevated parts of the county are the Malvern hills, on the west, 1440 feet high, which, though only a sheep pasture, have yet a fine climate; the Bredon and Broadway hills on the south, about 900 feet high, and the Lickey range on the north, about 900 feet in height, all of which are bleak and inclement. Every part of the county is covered with verdure and cultivation, and the rich orchards and flourishing hop grounds form interesting objects.

The soil of the county is chiefly a rich loamy sand, with a small proportion of gravel in the central parts. Towards the east the soil is a light sand with some spots of clay, but the eastern district is generally a stony clay. Between Worcester and the vale of Evesham on the south-east, the soil is partly rich marle and partly strong clay, while in some spots the subsoil is limestone. In the beautiful vale of Evesham, watered by the Severn, the soil is a dark earth, and particularly deep. Limestone occurs farther south in the upper lands, and a rich loam in the lower ones. In the south-west, between the Severn and the Malvern hills, the soil is clay mixed with sand. No chalk or flint occurs. The vale of the Severn is said to contain 18,000 acres of deep rich sediment, deposited by the river and its tributary streams. The lands of the county were lately distributed thus:—

	Acres.
Inclosed fields of arable land . .	340,000
Common fields of ditto . .	20,000
Permanent grass land . .	100,000
Kitchen gardens	5,000
Woods, wastes, rivers, roads, sites of towns	35,000
Total . . .	500,000

About 43,500 acres are supposed to be sown with wheat, yielding from 20 to 32 bushels per acre. Barley and beans yield remarkable crops. Hops are extensively cultivated, and pear trees are so abundant as to yield perry as the beverage of the peasantry. There is no breed of cattle or sheep in the county. Lean flocks from the poorer districts are fattened on the fine pastures of the county.*

The principal rivers are the Severn and the Avon, described under England, Vol. VIII. p. 502-513; and the canals have been described fully in our article Navigation Inland, Vol. XIV. p. 282.

The useful minerals of the county are coal, limestone, brick, clay, and excellent freestone. Fine coal is obtained in the N.W. about Mamble, and at Pensax there are coal mines, where it is used for the hop kilns. The veins, however, are little more than two feet thick, so that the county depends for its supply on the Staffordshire mines, the coals of which are brought down the Severn. At Dudley there is a vein 10 feet thick.† In the vale of Evesham, the poor burn the bean stubble.

There are mineral wells at Malvern, chalybeate springs at Kidderminster, and a dropping well on Barlisk common; but the most valuable are the salt springs of Droitwich, which have been fully described in our article England, Vol. VIII. p. 570.

The principal manufactures are gloves, porcelain, glass, iron, iron nails, table linen, needles, tenter hooks, carpets, oil and oil cake, of which some account will be found in our description of the principal town of the county.

The chief towns are Worcester, Dudley, Kidderminster, Broomsgrove, Stourbridge, Stourport, Bewdley, Evesham, &c. all of which are described under separate articles, excepting Dudley, Evesham, and Droitwich. Dudley is an ancient, but a regularly built town, with two parish churches, containing some monuments, one at each end of the largest street. The manufactures consist of all varieties of hardware. The population of the town and parish in 1821 was 3637 families, 3410 in trade, and total population 18,211. Droitwich is chiefly inhabited by the labourers of the brine pits, and contains no buildings of importance. The manufactures consist of coarse linens and salt. The population of the burgh in 1821 was 2176 persons, 269 families being employed in trade. Evesham is finely situated on the river Avon, which is crossed with a stone bridge of seven arches. The streets are irregular and the houses ancient and not well built. Its two churches are ancient, and the bells hang in a detached tower The only manufacture is one of knit stockings, the poor being chiefly occupied in gardening. The ivied walls of its once flourishing abbey still adorn the town. The population of the burgh in 1821 was 3487.

This county sends two members to parliament, two are returned by each of the burghs of Worcester, Droitwich and Evesham, and one from Bewdley.

Vestiges of Roman roads occur in the county, and various coins of the lower empire have been found near the large camp on Witchbury hill. An earthen pot full of coins was taken out of a pool on the side of that hill.

The population of Worcestershire, in 1821, was, houses 34,738, families 39,006, families engaged in agriculture 14,926, do. in trade 41,576; males 90,259, females, 94,165. Total population 184,424. See Mill's *Agricultural Survey of Worcestershire;* Nashe's *Survey, &c.*, and the *Beauties of England and Wales*, vol. xv. part 1. See also England passim.

WORKINGTON, a seaport town of England in the county of Cumberland, is situated near the south bank of the Derwent, about a mile from its embouchure. The new streets are neat and elegant, and contain some handsome houses, but the ancient ones are narrow and irregular. A neat square of 20 houses, containing the corn market, was built in the upper town. The church is a handsome building with a neat Gothic tower. The other buildings are a spacious workhouse, a neat assembly room, and a theatre, a Lancasterian school for 220 boys, and a female school for girls. On an eminence, near the east end of the town, stands Workington Hall, the seat of the Curwens. It forms an elegant quadrangle, and is surrounded with fine grounds and fields, brought into the highest state of cultivation by its late public spirited possessor. The Derwent is navigable for ships of 400 tons, and the harbour is safe and commodious. The quays have been enlarged, and there are now about 160 vessels belonging to the port, many of them from 100 to 300 tons. The exports are chiefly coals to Ireland and the Baltic, cannon and cast iron kettles. The imports are timber, bar iron, and flax. The manufactures are cordage, sailcloth, and the casting and forging of iron. There is an extensive salmon fishery on the Derwent belonging to Lord Lonsdale.

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* See England, Vol. VIII.

† See Mine, Vol. VIII.

Workington is distinguished by its extensive coaleries, belonging to Mr. Curwen, which we have described in our article CUMBERLAND, Vol. VII. p. 341. See also MINE, Vol. XIII. About 150 wagons, each containing three tons of coal, are shipped daily, and between 500 or 600 men are employed in the work. Population of the township in 1821, 1224 houses, 1751 families, 469 do. in trade, and 6439 inhabitants. The returns state that 439 sailors were absent.

WORLD is the assemblage of parts which compose the universe. See ASTRONOMY and METAPHYSICS.

WORSTED MANUFACTURE. See the references under WOOLLEN MANUFACTURE.

WREN, Sir CHRISTOPHER, a celebrated mathematician, natural philosopher and architect, was born at East Knoyle, in Wiltshire, on the 20th October 1632. His father, Dr. C. Wren, was rector of Knoyle, and dean of Windsor. At the age of thirteen, young Wren is said to have invented some new astronomical instrument, and to have dedicated an account of it to his father, in a Latin epistle. Owing to the delicacy of his health, he was educated by his father, and at the age of fourteen was sent to Wadham College, Oxford. At that early age his acquirements procured him the friendship of Bishop Walker, and Oughtred, in the preface to his *Clavis Mathematica*, mentions Wren as having acquired, at the age of sixteen, a knowledge of the mathematics and natural philosophy, which held out the promise of future distinction. One of the early inventions of our author was a kind of *Penna Duplex*, for which he took out a patent. He is said to have devoted his attention to the subject of vision through the microscope, and to have been assisted by Dr. Hooke in this inquiry. He soon after produced a theory of the planet Saturn, and an algebraic treatise on the Julian period. In 1653 he was elected a fellow of All-Souls College, and he soon afterwards went to London, where he devoted himself to the cultivation of the sciences. Wren is supposed to have about this time suggested that the variation in the height of the barometer was produced by the different weights of the superincumbent column of air, and the invention of the barometer even has been ascribed to him, but without any sufficient reason.

While Mr. Wren was at Oxford he devoted himself to the study of anatomy, and at the age of fifteen, he was employed as demonstrating assistant to Sir Charles Scarborough. He executed all the drawings for Dr. Willis's Treatise on the Brain, and he was the decided inventor of the celebrated physiological experiments, revived in our own times, of injecting various fluids into the veins of living animals.

In 1657, Wren was elected professor of astronomy in Gresham College, and his inaugural oration, which greatly extended his reputation, is published in Ward's Lives of the Gresham Professors. In 1650 he solved the celebrated problem of Pascal, which had been given as a challenge to English mathematicians, and he proposed another to the French mathematicians, which was never answered. In the year 1660, he invented a method for projecting Solar eclipses, and in the same year he established, along with ten other gentlemen, a weekly society, for the improvement of natural and experimental philosophy, which formed the foundation of the Royal Society. In 1661, after the restoration, he was elected Savilian professor of astronomy at Oxford, in the room of Dr. S. Ward, and in the same year he was made doctor of laws.

Among his various studies Dr. Wren had directed his attention to architecture, and such was his knowledge, that Charles II. sent for him from Oxford, to assist Sir John Denham, surveyor-general of public works.

On the 20th May 1663, he was elected a fellow of the Royal Society, by the first council, and he communicated to that learned body a vast variety of discoveries, inventions, and improvements, many of which were lost, and others secretly sent abroad and appropriated by foreigners. Many of these discoveries are enumerated by Dr. Sprott in his history of the Royal Society. The following brief enumeration will show the immense extent of his attainments, and the diligence with which he devoted himself to scientific inquiries.

1. A lunar globe, representing the surface of the moon, with its various mountains and cavities. It was contrived so as to show the lunar phases, and the shadows of the mountains, and edges of the cavities. A model of it was placed in the king's cabinet.

2. He wrote a history of the seasons as to temperature, weather, &c., and he contrived many meteorological instruments which registered their own indications, tracing out in lines the changes which took place in the observer's absence. The instruments which he thus improved were barometers, thermometors, hygrometers, pluviometers, and anemometers.

3. He made additions to the doctrine of pendulums, and he showed that a natural standard for measure may be obtained from the common pendulum.

4. He made many improvements in the construction and use of astronomical instruments. He fitted and suspended quadrants, sextants, &c., in an improved manner. He made two telescopes open on a joint like a sector, to take distances to half minutes, &c. He made improvements on micrometer screws and reticula, for taking small distances, and apparent diameters of the planets, &c. to seconds, and he made variable repertures to fit

glasses for crepusculine observations. He made maps of the Pleiades, and proposed to prove the earth's motion by examining the circumpolar stars.

5. In optics he made many improvements. He attempted, with some success, to make glasses of other figures than spherical. He measured and delineated the spheres of the humours of the eye. He explained the reasons of erect vision. He gave a new theory of fractions which agreed with observation; and he demonstrated the general phenomena of dioptrics, and the principles of refracting telescopes.

6. He made many useful suggestions and experiments on navigation. He made a magnetic terella, which he placed in the middle of a plain board, with a hole into which the terella is half sunk, like a globe with its poles in the horizon; steel-filings were then scattered with a sieve over the plane board, and they immediately arranged themselves into a sort of helix, proceeding, as it were, out of one pole, and returning in by the other.

In the practice of seamanship he made many experiments. He investigated the theory of sailing in all winds,—the geometrical mechanism of rowing, swimming, and flying,—and the resistance which bodies experienced in moving through fluid media.

7. In the useful arts his contrivances were numerous. He invented the art of mezzotinto engraving, an art which Prince Rupert greatly improved. He suggested many useful improvements in waterworks. He invented the art of drawing pictures by microscopical glasses. He constructed perpetual, or long-lived lamps, for maintaining a constant heat, for the purpose of hatching insects, rearing plants, preserving chemical preparations, imitating nature in producing fossils and minerals, and keeping the motion of watches equal for finding the longitude, and for other astronomical purposes.

In 1669 he communicated to the Royal Society a *description of an instrument for drawing the outlines of any object in perspective.* It is published in the Transactions, No. 45, p. 898.

In the same year he communicated to the Society, a paper entitled *the Generation of an Hyperbolical Cylindroid, and a hint of its application for grinding hyperbolic glasses.*—See Philosophical Transactions, No. 48, p. 961.

Sir Christopher afterwards resumed the consideration of the subject, and communicated the *draught* of an engine for grinding hyperbolical glasses. See Philosophical Transactions, No. 53, p. 1059.

The idea contained in these two papers is ingenious and beautiful, but we fear not likely to answer in practice; though with the exquisite workmanship of modern times, we think it might be resumed with considerable probability of success.

When Mr. Wren was at Oxford, he was employed by the king to make drawings of animalculæ seen by the microscope; and such was their merit, that Dr. Hooke, in his preface to his Micrographia, states, that he began it with reluctance, as he had to follow the footsteps of so eminent a person as Dr. Wren, who was the first that attempted any thing of this nature, and whose original draughts made one of the ornaments of the great collection of rarities in the king's closet. He then adds, "I must affirm of him, that since the time of Archimedes there scarce were met in one man so great a perfection—such a mechanical head, and so philosophical a mind." Sir Isaac Newton speaks of Sir Christopher with equal praise, and names him along with Wallis and Huygens, as one the first mathematicians of the age.

Such were the scientific labours of this eminent individual, but though he did not abandon his early studies, yet his mind was now directed to new objects, which, while they principally occupied his mind, conducted him to fame and honours if not to fortune.

Charles II. had, soon after the Restoration, contemplated the repair of St. Paul's Cathedral, and in 1660 commissioners were appointed, of whom Dr. Wren was one, to superintend the restoration of it. Some of the commissioners were for "patching it up any how, so the steeple might stand instead of a new building," while Sir Christopher proposed to rebuild the steeple with a cupola. With a view of preparing himself for this work, he went to Paris in 1665, to study the principal edifices of that capital, and after great expense and labour, he brought home views of almost all the great public buildings in France. At Paris he met with Bernini and Mansard, who were then occupied with the Louvre. He declared that he would have given his skin for Bernini's design of that great palace, but he adds, "the old reserved Italian gave him but a few minutes view of it." It was a fine little draught, on five pieces of paper, for which he had received as many thousand pistoles. I had only time to copy it with my fancy and memory, and I shall be able by discourse and a crayon, to give you a tolerable account of it." Sir Christopher returned to London in 1665, and he appears to have made more progress in a work entitled "Observations on the present State of Architecture, Arts, and Manufactures in France," but it was never published.

The repairs of St. Paul's were now begun, and the scaffolding was raised; but when the commissioners were disputing whether the repairs should be trivial or on a great scale, the conflagration of 1666, which took place five days after, put an end to the contest, by injuring the cathedral so as to render its restoration impossible.

The destruction of the capital of England, and of its sacred edifices, was an opportunity furnished by providence to call forth and display the inventive genius of our great architect.

In our Article Civil Architecture, Vol. VI. p. 490—495, &c. we have given such a copious and minute account, not only of the erection of St. Paul's, but of the numerous churches designed by Sir Christopher Wren, that it would be superfluous to say a word more on the subject. We shall therefore conclude this article with such particulars of the life of Sir Christopher as are not given in the above article.

A few days after the great fire Sir Christopher drew the plan of a new city, which was submitted to the king, but rejected by the parliament. He had been for some time associated with Sir John Denham, the surveyor-general, as his deputy, but without any salary, till the spring of 1668, when, on the death of Sir John, he was appointed surveyor-general, and had then the charge of many public edifices. Besides St. Paul's, and the churches in the metropolis, he designed the Sheldonian theatre at Oxford, the chapel of Pembroke Hall, the library of Trinity College, the monument of London, the modern part of Hampton Court, Chelsea College, and one of the wings of Greenwich Hospital, the hunting palace at Winchester, now turned into barracks. Of these the palace at Hampton Court and Winchester are the least favourable specimens of his genius. His pendulum stage, in the upper part of the spire of Chichester Cathedral, which he rebuilt in order to counteract the effect of the south-westerly gales, which had forced it from a vertical line, is a fine specimen of his genius.

The great pressure of his business compelled him in 1673 to resign his professorship at Oxford. In 1674, he received the honour of knighthood. He was one of the Commissioners appointed to select a place for a royal observatory, and he chose Greenwich for this purpose. In 1680, he received the high honour of being elected President of the Royal Society. He was subsequently appointed architect and commissioner to Chelsea College, and in 1684, comptroller of the works in Windsor Castle. He sat twice in parliament for two different boroughs. The ingratitude of his country, or rather the baseness of the government, was strikingly displayed in its refusal to pay him the arrears of his salary of £200 per annum. They amounted to £1300, and it seems to have been wrung from the public purse, more from a feeling of shame, than from a sense of justice. He did not receive it till December 25, 1716, when he was about to enter his 80th year. After the death of Queen Anne, Sir Christopher was deprived of the royal patronage. By a wretched court intrigue, this ornament of his country was displaced from his office at the age of 90, but his religious principles and the natural vivacity of his mind, enabled him to bear this unmerited insult. The last years of his life were spent in perfect serenity, and his faculties were unclouded to the very close of his existence. His chief delight was to be carried once a year to see the great memorial of his name. He was found dead in his chair on the 25th February 1723, in the 91st year of his age. A splendid funeral was decreed to him, and his remains were deposited in the crypt under the southernmost window of the choir of St. Paul's. A plain black slab lies above the coffin, but no monument has been reared to his name. On the western jamb of the window of the crypt is a tablet with the following appropriate and sublime inscription:

Subtus Conditur
Hujus Ecclesiæ et Urbis Conditor
CH. WREN,
Qui vixit annos ultra nonaginta
non sibi sed bono publico.
Lector, si monumentum quæris
Circumspice.

This inscription was afterwards placed in gilt letters in front of the screen of the organ by Mr. R. Milne, one of Sir Christopher's successors.

Sir Christopher Wren was first married to the daughter of Sir Thomas Coghill, by whom he had one son, and afterwards to a daughter of Lord Fitzwilliam, by whom he had a son and a daughter.

For further information respecting this eminent person, see the *Parentalia*, or *Memoirs of the family of the Wrens*, folio, Lond. 1750, begun by the son of Sir Christopher Wren, but finished by his grandson, Stephen Wren.

A beautiful full length portrait of Sir Christopher Wren by Sir Peter Lely, is now in the possession of Sir James Wright, Bart. of Carolside, in Berwickshire.

WRESTLING. See Athletæ, Vol. III. p. 42.

WREXHAM, a market town of Denbigshire in North Wales, is situated on a small stream running into the Dee, and consists of several streets radiating like a star. The streets are spacious, and the buildings in general good. At the upper end of the High street is a handsome edifice of the Doric order, the upper part of which is used as a municipal hall, and the piazza below as a market place. The church is a beautiful edifice, superior to many English cathedrals, and is reckoned the seventh wonder of North Wales. It consists of a pentagonal chancel, a nave, two collateral aisles, and a lofty quadrangular tower at the west end. The tower, which is 135 feet high, is a specimen of the finest architecture. It is quadrangular, with elegant abutments, terminating in crocketted pinnacles, and the summit is crowned with four pierced lantern turrets, which rise 24 feet above the open work ballustrade. A circular staircase is attached to each of the turrets. Full length statutes of thirty saints are placed on the niches of the buttresses, and show the state of statuary at the end of the 15th century. The interior is spacious and handsome, the ceiling of the roof being peculiarly fine. The alter-piece, which is very handsome, is decorated with a painting of the last supper, supposed to be by Rubens. The church contains some beautiful monuments, among which that by Roubilliac to the memory of Mary Myddleton, daughter to Sir Richard Myddleton of Chirk Castle, is the most striking, and perhaps a more beautiful work of art is not to be found in England. A most lovely female figure, attired in her nocturnal robes, is exhibited in the act of bursting the tomb, and rising from the sarcophagus. The countenance and attitude are angelic, and the mingled feelings of surprise and delight are finely blended and forcibly expressed.

Another monument by the same great artist is at the end of the north aisle. It is a mural one, with medallions of the Rev. Thomas Myddleton, and Arabella Flacker his wife. Besides the church, there are two large meeting-houses, a commodious town hall, and a well endowed free school. In the vicinity, there are several manufactories of warlike instruments, particularly a large foundry for cannon. A work for smelting lead is also in the neighbourhood. Great quantities of flannel are made in the town and its vicinity. The great annual fair of Wrexham begins on the 23d March, and continues for nine days. Population of the township of Wrexham Regis in 1821, 665 houses, 706 families, 420 ditto in trade, and total number of inhabitants 3091.

WURTEMBERG. See Wirtemberg.

WURZBERG, a city of Bavaria, is situated on the Maine, in a hollow, with the valley of the Maine extending in two directions, and another valley running to the north. The Maine, which is here a small stream, divides the town into two parts (of which the larger is on the right bank) which are joined by a handsome bridge. The town is poorly built; its streets are irregular, and scarcely any of its buildings are of stone, except some of the public ones. The town contains two squares, one of which is in front of the palace, while the other forms the market-place. The principal public building is what was once the bishop's palace, and is a large oblong building on the plan of Versailles. The vault of the great staircase by Tiepolo, is a chef-d'œuvre of architecture. The great hospital called *Julius' Hospital,* is a large and irregular building, and possesses a fine church, a botanic garden, a collection of natural history, and of surgical instruments. The cathedral is a large, but indifferently built edifice. There are many churches in the city, but none of them are remarkable. The university contains some medical and surgical classes, and a good library. The town is surrounded with a mound and moat, and has a citadel on a hill on the left bank of the river. The manufactures of this town are upon a very small scale. Many thousand acres round the town are occupied with vineyards which produce the best wines of Franconia. Population 21,000.

WYCLIFFE, John, the Father of the Reformation, not only in England, but in all Europe, was born about the year 1324. His surname was derived from the village or parish of Wycliffe, the place of his birth, six miles from Richmond, Yorkshire, of which his family were proprietors from the Conquest till the year 1606. He was early destined for the church, and entered Queen's College, Oxford, in the seventeenth year of his age. He afterwards removed to Merton College, in the same university, which latter institution could boast of some of the most eminent characters of that period. He soon indeed became as distinguished as any of them. Not only did he become eminent as a dialectician, and mastered all the intricacies of the Aristotelian system, but he applied himself to the study of the sacred volume; a practice equally uncommon and despised: he perused with equal assiduity the writings of the Fathers; and so profound and minute was his acquaintance with the Christian system, that he was honoured with the title of Evangelical Doctor. This knowledge soon led to important results: even at first it disclosed to him the corrupt and hollow character of popery, and induced him to manifest little respect either for that hierarchy or for its ministers. This became evident from his first publication, entitled "The Last Age of the Church," which appeared in 1356; and soon afterwards, in his dispute with the mendicant friars, who had interfered with the discipline and privileges of the university. From defending this seminary, he proceeded not only to attack these coenobites, but the church to which they belonged; and the more he read and meditated on this subject, the more clearly he perceived the abominations of popery. The cause of the university was carried before parliament, before which court Wycliffe advocated in person the views which he had espoused; and though he was successful there, yet, on appeal to the pope, the mendicants obtained a dispensation in their favour. Not long after this the pope made encroachments on the independence and prerogatives of the Anglican church, by conferring the richest benefices of the kingdom, not solely on foreigners, but on mere children. Parliament took up the question; and commissioners being nominated to confer with the pope on the subject, Wycliffe was appointed one of them. These commissioners were not permitted by his holiness to repair to the papal residence, but delegates were appointed to meet them at Bruges. The embassy terminated unfavourably to the English nation, but it enabled Wycliffe to trace more fully the corruption of the Romish hierarchy, and to inspect more nearly the fountain from which they flowed. On a subsequent occasion, the parliament of England consulted Wycliffe on a question of a similar nature, namely, whether, in case of necessity, and as the means of the defence of the country, the king was entitled to detain its treasure, and to forbid contributions to the pope, even under pain of the censure of his holiness. This question he fearlessly answered in the affirmative, supporting his view in a disquisition equally candid, learned, and judicious.

Meanwhile his merits had not gone unrewarded. In 1361, he had been elevated by the university to be master of Baliol College; about the same time he was presented to a rectory in the church, and in 1365 raised to the wardenship of Canterbury Hall; from which last situation he was ejected on an appeal to the pope; a circumstance which probably urged him more zealously to oppose that tyranny of which he was himself a victim. He was afterwards appointed Professor of Divinity, and presented with the rectory of Lutterworth; situations conferred on him by the king. He resided at his rectory, and most zealously performed the duties of a parish minister there, except during the session of college, when he as faithfully devoted himself to the discharge of his academical functions. His opinions, expounded and enforced both in the pulpit and his place as professor of divinity, rapidly spread, and, in spite of ancient prejudices or ignorance, became popular, and were imbibed by persons of the greatest rank and influence. In the meantime he was the object of the most rancorous persecution on the part of the church, urged on by the pope; proceedings of which an account cannot here be given. Under every circumstance, he displayed the utmost fortitude, and an unflinching regard to sound doctrine. On one occasion, when labouring under a dangerous malady, some mendicant friars entered his chamber, in order to induce him to recant what they regarded as heresy. They knew little of the man with whom they had to do. Lifted up in bed by his servants, and emaciated as he was, he cried with a loud voice,—"I shall not die but live, and yet declare the evil deeds of the friars." In 1382 he was driven from Oxford, but his rectory still remained to him, to which he retired.

Important as were the transactions in which he was engaged, his translation of the Bible was by far the greatest work he accomplished, and it achieved the most splendid triumphs in the cause of the Reformation. It introduced a light which gradually dispelled the darkness which for many centuries had prevailed, and put an end to ignorance, imposture, and superstition. This great work he accomplished in 1383. Several manuscript copies are to be found; but his translation of the New Testament was published by Lewis in 1731, and reprinted in 1810, under the superintendence of Mr. Baber. Not acquainted with the Greek or Hebrew languages, not then known in the country, he had recourse to the Latin vulgate as his text.

After his retirement to Lutterworth, his life and liberty were, as before, in imminent danger. He was immediately summoned to appear before the pope at Avignon, but sickness prevented him from obeying the summons: in truth, his constitution for many years had been rapidly giving way, and his health gradually undermined by the immense labour he underwent, as well as by anxiety of mind. He died on the 31st of December 1384, in the sixtieth year of his age.

Such is a short memoir of John Wycliffe—"that Englishman," to use the words of Milton, "honoured of God to be the first preacher of a general Reformation to all Europe."

He was a man of great learning,—of extensive and varied reading,—of undaunted fortitude,—of warm attachment to truth,—regardless of personal considerations, and of eminent piety. He renounced the authority of the pope: he exposed the corruptions of popery; he clearly pointed out the way for those reformers, both at home and abroad, who were to come after him. But he lived in a remote age; and it is a curious fact, that he continued till his death a nominal member of that church which he laboured to expose and undermine. One half of the nation, before his death, are said to have embraced, in a greater or less degree, his opinions, which spread with wonderful rapidity over Europe. His writings were very numerous, amounting to no fewer than eighty-two. By an order from the pope his body was disinterred forty-four years after his death. It was burnt to powder, and thrown into the Swift, a small stream that washes the village of Lutterworth. About the same time, and by the same authority, such copies of his works as could be got, were committed to the flames at Oxford, as if such proceedings could annihilate his labours or stop the progress of truth.

Various *Lives* of Wycliffe have appeared, but those of Lewis and Vaughan, the first published in 1731, the other in 1828, in two vols, are the best.

(T. M.)

WYCOMBE, HIGH, or CHIPPING WYCOMBE, a borough town of England, in Buckinghamshire, is situated in a valley on the banks of a stream which runs through the parish, and turns some paper and corn mills, and falls into the Thames below Marlow; the High Street is spacious and well built, and has several smaller ones branching from it. The church is a handsome stone building, with a tower 108 feet high. The chancel contains a fine monument to Lord Shelburne, who died in 1751, and in the south aisle is another handsome one by Carlini, to the Countess of Shelburne, who died in 1791. Above the communion table is a large painting of St. Paul converting the Druids. The town hall, erected in 1757, by John, Earl of Shelburne, is a large brick building, sustained by 34 stone pillars. The other establishments are a grammar school and an almshouse. The manufactures of the place are paper, which is made to a great extent, and a small quantity of lace. A tesselated pavement and various Roman coins have been found near the town. Wycombe sends two members to Parliament. Population of the borough in 1821, 516 houses, 563 families, 376 ditto in trade, and total number of inhabitants 2864. See the *Beauties of England and Wales*, vol. i. p. 362.

WYTHE, county of Virginia, bounded S. W. by Washington, N. W. by Tazewell, N. by Giles, N. E. by Montgomery, and by the Iron mountains separating it from Grayson S. E. and S. It contains and is in part composed of a mountain valley; greatest length along the valley from S. W. to N. E. 48 miles; breadth about 22; area 1056 square miles; extending in Lat. from 36° 40′ to 37° 8′ N., and in Long. from 3° 36′ to 4° 32′ W. from W. C. Wythe valley is an elevated table land. From the southwestern part issue the extreme fountains of the middle fork of Holston river, interlocking sources with those of various creeks flowing into New river. Comparing the elevation of Wythe with that of Giles county, will give to the former an elevation exceeding a mean of 1600 feet. The cultivated land of Wythe must indeed rise between 1600 and 2000 feet above the ocean level. Wythe Court House. See Evansham. DARBY.

X.

XANTHIC Oxide, from ξανθος yellow, is the name given by Dr. Marcet to a very rare species of calculus. It is of a reddish or yellow colour, soluble both in acids and alkalies, and its solution in nitric acid when evaporated, possesses a brilliant yellow tint, from which it derives its name.

XANTHOGEN, from ξανθος *yellow.* and γενναω *to generate*, is the name given by M. Zeise to the radical of a hydracid which he calls the *hydroxanthic acid*. The acid is a compound of carbon, sulphur, and hydrogen, and the radical he supposes to be a sulphuret of carbon. When bicarburet of sulphur is agitated with an alcoholic solution of pure potash, the alkaline properties of the potash wholly disappear, and acicular crystals are deposited at a temperature of 32°. M. Zeise ascribes these phenomena to the production of a new acid, the elements of which he considers to be derived from the alcohol and the bisulphuret.

XENOPHON, a celebrated ancient historian, philosopher and general, was born in Attica, and in consequence of his engaging appearance and manners, he was admitted among the disciples of Socrates. In the Peloponnesian war, to which he accompanied Socrates, he exhibited the first proofs of his valour, but his skill as a general was displayed in the war which Cyrus waged against his brother Artaxerxes. Cyrus, having fallen in battle in the plains of Cuanaxa, Xenophon, who was a volunteer in his army, advised his countrymen who had joined the Persian standard to retreat, and being chosen their commander, he conducted the celebrated retreat of the ten thousand, of which he has himself given so interesting an account. He afterwards fought under Agesilaus in the battle of Cheronea, and having given offence to his country by that act, as well as by his former services to the Persian army, he was condemned to banishment. The Spartan government immediately protected him, and provided for him a comfortable retreat at Scillus in Elis, where, amid the peaceful enjoyments of domestic life, in the society of his wife and two children, he composed those historical works which have immortalized his name. The wealth which he had acquired in his Asiatic expedition enabled him to improve and adorn the country around Scillus. He erected a magnificent temple to Diana, in imitation of that of Ephesus, and he spent part of his time in hunting and in rural amusements. These peaceful pursuits, however, were not destined to last; a war between Lacedemon and Elis drove him from his retirement to the city of Corinth, where he died at the great age of 90, and 359 years before the Christian era. His principal works are his *Anabasis*, or account of the expedition of Cyrus. His *Cyropædia*, a sort of moral romance, though supposed by some to be an exact account of the life and actions of Cyrus the Great; his *Hellenica*, a continuation of Thucydides's history, his *Memorabilia* of Socrates, and his *Apology*. His other works, which are small treatises, are his Eulogium on Agesilaus, his Œconomia; his tract on the Duties of Domestic Life; his dialogue entitled Hiero; his treatise on Hunting; his *Symposium;* his tract on the office of the Master of the Horse; his treatise on the Governments of Athens and Sparta, and his tract on the revenue of Attica. The best editions of Xenophon are those of Leunclavius, folio, Frankfort, 1596; of Ernestus, 4 vols. 8vo. Lips. 1763; and of Zeunius, 6 vols. 8vo. Lips. 1778-1791.

XERXES, the son of Darius I. succeeded to the Persian throne B.C. 489; after reigning 25 years, he was murdered by his own guards in B.C. 465. An account of his actions will be found in our articles Athens, Greece, and Lacedæmon.

XIPHIAS. See Ichthyology.

Y.

YAKUTSK, or Iakutsk, a town and province of Russia, in the government of Irkutsk. See Irkutsk.

YARMOUTH, Great, a seaport town of England in the county of Norfolk, is surrounded on the south and east by the sea, and is situated on the east side of the Yare, over which there is a handsome stone draw-bridge, which connects it with Suffolk. The town is an oblong square, about a mile long, and half a mile broad, including an area of 33 acres. It contains four parallel streets, crossed by 156 narrower ones or rows. The town is encompassed with a wall on all sides but the west, about 2240 yards long. The church of St. Nicholas consists of a nave, two aisles, and a transept. The organ is considered to be of a very superior kind. In 1716 a handsome chapel was erected, and dedicated to St. George. The town-hall situated near the centre of the quay, is an elegant edifice with a Tuscan portico. The commercial hall, sometimes used for assemblies, is a handsome apartment, having at one end a fine portrait of George II. A neat theatre was built in 1778. The other public buildings are the Fisherman's hospital, a large square edifice; the hospital school for 30 boys and 20 girls; the subscription charity school for 70 boys and 30 girls; the barracks built on the beach, and capable of holding 1000 men, and the armoury lately erected by Mr. Wyatt, on the west side of the town, capable of holding 10,000 stand of arms, besides a great quantity of naval stores.

The quay at Yarmouth is supposed to be the finest in Europe. From the south gate to the bridge its length is 1014 yards, and it extends 1016 yards beyond this for smaller vessels, being a length of one mile and 270 yards. It is in many places 150 yards wide. A range of handsome buildings adorns the southern part of it. The harbour is formed by two piers. The principal one on the north is 235 yards long, 40 feet wide at bottom, and 20 at top. The south pier is 340 yards long, 30 feet broad, and 30 deep, 24 feet of the depth being commonly under water. The extent of the harbour between these two piers is 1111 yards. It has two light-houses, one at Caister and one at Garleston. Owing to the dangerous character of the coast, this harbour is the resort of shipping in easterly storms. The annual expense of the harbour is about £2000.

Yarmouth enjoys great commercial advantages owing to its situation at the mouths of the rivers Yare, Thyrre and Waveney, which are navigable for keels of 40 tons. The vessels belonging to the port excluding fishing smacks, amount to 300, Yarmouth being the eighth port in England for the quantity of shipping. The herring fishery which is carried on in boats of from 40 to 50 tons, gives subsistence to 6000 persons. The trade in coal is also great. Great quantities of corn and malt are shipped for London. The woollen manufactures of Norwich and the vicinity, are exported in great quantities, and a considerable trade is carried on with the Netherlands, Norway, and the Baltic, from which timber and naval stores are imported. Ship-building is carried on to a considerable extent.

The town is defended by three forts, erected on the verge of the beach, and mounted with 32 pounders. The harbour is defended by two bastions. There are two banks in the town, a court of admiralty, and a small court for the recovery of debts between £2 and £10.

As a place of fashionable resort for sea-bathing, Yarmouth has every proper accommodation, and is much frequented. A bathing-house was erected on the beach in 1759, with separate baths for gentlemen and ladies, the sea water being raised by a horse mill. A public room was added to this building in 1788. There are also good bathing machines on the beach. Yarmouth returns two members to parliament. Population of the borough in 1821, 3981 houses, 4318 families, 1286 ditto in trade, 10 in agriculture; 7649 males, females 10,391. Total number of inhabitants 18,040.

YARROW. See Selkirkshire.

YATES, county of New York, bounded W., N.W. and N. by Ontario; E. by Seneca lake separating it from Seneca county, and S. by Steuben county. It is about equal to a square of 18 miles, or contains an area of 324 square miles. Extending in Lat. from 42° 32′ to 42° 46′ N. The meridian of W. C. touches the eastern border, and the county extends westward to Canandaigua lake, 22′ from the meridian of W. C. The surface is a congeries of high and steep hills, with a very productive soil.

In 1830, the population amounted to 19,009, or very nearly 60 to the square mile. In 1831, it had post offices at Penn Yan, the seat of justice, and at Barrington, Benton, Benton Centre, East Barrington, Harpending's Corners, Italy, Italy Hill, Jerusalem, Middlesex, Milo Centre, Starkey's, West Dresden, and Yatesville.

Penn Yan, the seat of justice, stands at the outlet of Crooked Lake, 185 miles westward from Albany, and 344 miles N. of W. C. Population not given in the census of 1830.

YAZOO, river of the state of Mississippi, having its remote sources in the northern part of the state; Lat. 34° 45′, interlocking sources with those of Tombigbee branch of Alabama, Silver creek, flowing into Tennessee river, and Wolf river, flowing into Mississippi river in the state of Tennessee.

Winding from this elevated tract the Yazoo winds to the S.W. entering the Mississippi at N. Lat. 32° 22′ after a comparative course of about 200 miles.

As laid down on Tanner's United States, there is an outlet represented as leaving the left bank of the Mississippi, 25 or 30 miles above the mouth of St. Francis river. This outlet, after flowing to S.E. 10 or 12 miles, is made to separate into two channels. The left or eastern is continued to S.S.E. 76 miles to its union with the Yazoo, about 125 miles above the mouth of the latter. The right or western channel, after a comparative course of 150 miles, is also united to the Yazoo, at the northeastern angle of Warren county, 25 miles above the mouth.

If these delineations are correct, there is included in the state of Mississippi, an elliptical annually inundated tract of 170 miles long, between the Yazoo and Mississippi rivers, with a breadth, where widest, of 70 miles, and a mean breadth of at least 40, with an area of 6800 square miles. Darby.

YBERA, or Iberi. See Buenos Ayres.

YEAR. See Chronology.

YEAST. See Baking, Bread, and Fermentation.

YELLOW RIVER, or Hoango. See China, and Physical Geography, Vol. XV. p. 607.

YEMEN. See Arabia, *passim*.

YENISSEI, or Jenissey. See Russia and Physical Geography, Vol. XV. p. 607.

YONNE, one of the nine central departments of France. It contains about 2900 square miles, or 729,223 hectares. A chain of hills crosses the southwest part of it, but the surface is generally undulating; consisting of little hills. Corn, hemp and flax are cultivated, though the soil is not good. The pasturage is superior to that of the maritime districts, and many parts of the department are covered with woods and pools. The manufactures are linen, woollen and cotton goods, and hardware articles. About 100,000 hogsheads of wine are annually made. Population in 1827, 342,116, being at the rate of 400 for every 1000 hectares. The increase of population since 1822 has been 2211.

YORK, a city of England, and capitol of Yorkshire, is situated in the midst of an extensive plain on the banks of the River Ouse, which is crossed by a bridge of three elliptical arches, the central one of which is 75 feet wide, and 22½ feet in rise, the span of the lateral arches being 65 feet each, and their rise 20 feet. It was begun in 1810 and finished in 1820. The town is entered by four principal gates, with four posterns. The town forms an irregular pentagon, being about 1340 yards long from north to south, and 1360 from east to west, including within its walls an area of about 300 acres, being about two miles and three-quarters in circuit. The streets are irregularly laid out, but they have been greatly improved by paving and widening, and they contain many handsome buildings, both public and private. The river Foss, which was long a piece of stagnant water, has been rendered navigable, and is crossed by five bridges, Foss bridge, which is 35 feet wide, and consists of an elliptical arch 35 feet span, Monk bridge, Layerthorpe bridge, Castlegate bridge, and the New Walk bridge. The great ornament of York is its cathedral or minster dedicated to St. Peter of which we have already* given the dimensions and various particulars. This magnificent building was completed between 1227 and 1377, and consists of various styles of Gothic architecture. The western front, with its two uniform steeples, is particularly grand. It was all cloistered for statues, but many of them have been carried away. The eastern end containing the choir is built in a more florid style, and is crowned with elegant niches of airy pinnacles. The statue of Archbishop Thoresby, the founder of the choir, is placed over its superb window, and at the base of the window are the heads of our Saviour and the Apostles, with that of a sovereign supposed to be Edward III. The great tower or lantern steeple is sustained within by four large and massy columns, forming four arches, and is of a different style from the other towers. The south transept, the latest part of the minster, is distinguished by a number of narrow and acutely pointed arches with slender pillars. The windows are small, and their ornaments different from the rest of the church. The south side of the choir is peculiarly striking, from its massy columns terminating in highly ornamented pinnacles, the size and beautiful tracery of its windows, and the screen work before the three southeast windows of the upper tier. The north side of the minster is equally grand. The north transept and nave, and chapter-house are rich and interesting. The interior of the church corresponds with its exterior magnificence. The cross aisle is superb. The circular arch is here seen enclosing others of a pointed form. The windows are long, narrow and pointed.

The north and south transepts are in the same style. The windows in the north end are disposed in two tiers, the lowermost of which consists of one window of exquisite beauty, divided into five lights, each about 50 feet high and 5 feet broad.

The view from the western entrance to the cathedral is unequalled, the eastern end of the minster, with its columns, arches, and superb window, being finely displayed. The screen which separates the nave from the choir is of the most florid and curious workmanship. The eastern window is unrivalled for beauty and magnificence. Upwards of 200 compartments are filled with representations of the Supreme Being, monarchs, prelates, and saints, and the chief events of sacred history.

The chapter house is a magnificent and singular structure. It is an octagon 63 feet in diameter and 68 feet high. Not a single pillar stands in this immense space, the roof being a specimen of great mechanical ingenuity. The cathedral of York contains the remains of a great number of distinguished characters; but though their monuments have perished, yet many of those of later date still remain to remind us of the vanity of all earthly grandeur.

In the beginning of 1829, an incendiary of the name of Martin, afflicted with religious madness, contrived to introduce himself into the church, and to set fire to it, but the fire was fortunately discovered before its ravages had become great. The injury, however, which was thus done to the building was very great; but the noble liberality of the nobility and gentry connected with the county, is now repairing the desolation which was thus wantonly committed upon so magnificent a pile.

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* Civil Architecture.

Besides the cathedral, York contains twenty-one parishes within its walls, and three in the suburbs. The most important of these are All-Saints, with a fine spire; St. Mary's, with a beautiful and lofty spire; All-Hallows, which stands on the highest ground in the city, and has a tower or steeple of exquisite Gothic; St. Dennis, which is a handsome building, and the church of St. Margaret with its fine porch.

One of the most interesting objects in the city is the remains of the monastery of St. Mary, which is situated under the walls without, and on the north side of the city. The only remains of this magnificent structure are a small part of the abbey church or cloister, and some spacious stone vaults.

The castle of York, now the county jail, is about 200 yards from the Ouse. The castle was taken down and the jail built in 1701. The prison for debtors is unequalled in the kingdom. The gaoler's house is on the ground floor, a fine flight of steps leads to the first floor, on which are eleven rooms, each 16 feet square and 12 feet high, and above this is the same number. In the left wing there is an elegant chapel. The male and female prisoners are kept separate.

The basilicon, or new county hall, is a superb edifice of the Ionic order, 150 feet long and 45 broad. The court for trying pleas is in the south end, and that of nisi prius in the north end. Each of these is 30 feet in diameter, surmounted with a dome 40 feet high, sustained by 12 Corinthian columns. The entrance is a loggio of six columns 30 feet high. It was first opened at the summer assizes of 1777. The walls of York castle are about 400 yards in circuit. Near the castle is an artificial mount about 90 feet above the level of the river, and on the summit of it stands Clifford's Tower, a circular building containing a well of excellent water.

The mansion house, erected in 1725, is a handsome building. Its front is of the Ionic order, and its apartments are spacious and well decorated.

The guildhall, a fine Gothic hall erected in 1446, stands behind the mansion house on the banks of the river. It is 90 feet long, 43 broad, and 30 high.

The assembly rooms in Blake Street, built in 1730, consist of an antique Egyptian hall, after Palladio, 112 feet long, 40 broad, and 40 high. The lower part consists of forty-six rich Corinthian columns, and the upper part is ornamented with rich composite columns.

Magnificent as the buildings are which we have now described, there is one just finished, viz. the Yorkshire Museum, which reflects the brightest honour on the Philosophical Society, and the public spirit of the nobility and gentry by whom it has been reared. It is a noble monument of individual liberality to the intelligence of the age, and acquires double value from having risen at a time when the government of the country, forgetting the true greatness of England, has ceased to protect and encourage the arts and sciences which have so long been the glory of our country.

This building stands in an enclosure of three acres, part of the site of the Abbey of St. Mary, which was granted by his present Majesty in 1827, to the Yorkshire Philosophical Society. The ruins of the Abbey occupy the side of the enclosures; the Roman multangular tower and ancient city walls separate it from the city to the south-east. On an eminence in the centre, the museum rears its noble front, looking down upon the river, and to the extensive landscape beyond. The entrance to the grounds from the city is by a Doric gateway. On either side of the walk leading thence to the museum, the ground is appropriated to a botanic garden; the remainder of the enclosure is planted.

The front of the museum extends 102 feet, and was designed by William Wilkins, Esq. In the centre is a portico of four Grecian Doric columns, (3 feet 6 inches diameter, and 21 feet 6 inches high) extending 35 feet, and projecting 10 feet, with bold steps all round it. The space on each side of the portico, which is terminated by an antæ pilaster, has three windows, ornamented by suitable architraves. A bold massive Grecian pediment is supported by the columns, and the entablature continues the whole length of the front, and returns round the ends of this building, which is about 24 feet wide. These ends have antæ pilasters at each angle, supporting a massive architectural screen to the roof, imitated from the choragic monument of Thrassyllus, at Athens. The whole of this building is faced with Hackness stone, a fine variety of the Kelloway rock from the quarries of Sir J. V. B. Johnstone, Bart., the gift of the munificent proprietor.

From the portico, the entrance into the building is by spacious folding doors, with a light over them resembling that over the door of the pantheon at Rome.

The internal arrangements were principally founded on a design made by Mr. Sharpe, in 1825, and subsequently much enlarged and improved. The hall is 29 feet 6 inches, by 18 feet 6 inches. The floor is formed of Scagliola plaster, by Mr. Ellison, in imitation of porphyry. The walls resemble stone, and the ceiling being divided into bold pannels, gives the whole a very massive and suitable effect. On the right of the hall is the library, 31 feet 9 inches, by 18 feet 6 inches. Here the books and miscellaneous antiquities belonging to the society are deposited. A door on the left of the library leads to the stair-case and council-room. Directly opposite the front door, corresponding folding doors lead into the theatre or lecture-room, 35 feet by 44 feet. This beautiful room is ornamented by six Corinthian columns, and four pilasters supporting beams, enriched by guilloche ornaments, dividing the ceiling into four principal compartments, in each of which are two rows of deep caissons; those of the two middle divisions are filled with ground glass, through which the room is lighted. By a simple, but ingenious contrivance, these lights can be instantly obscured by shutters, at the command of the lecturer, whenever any experiments require to be performed in the dark. The seats of the spectators, which are equally handsome and commodious, gradually descend from the level of the entrance-hall towards the table of the lecturer, situated opposite the entrance, and nearly on a level with the basement floor. The lower part of the lecture-room is rusticated, and the whole of the walls and part of the floor are in imitation of stone. On the right and left of the lecture-room, and communicating with it, are spacious apartments, 61 feet 6 inches long, by 18 feet 6 inches wide, for the collections in geology and mineralogy; the former containing a suite of nearly 10,000 specimens of British rocks and fossils, arranged in the order of their position in the earth; the latter exhibiting above 2000 minerals, classed according to their chemical relations. At the back of the lecture-room, and connecting the two lateral rooms, is the museum for zoology, 44 feet by 22 feet, in which the Foreign and British quadrupeds, birds, reptiles, fishes, shells, insects, and corallines, which the society possesses, are systematically displayed. These three rooms are lighted by plate-glass skylights, and are admirably suited to their purpose.

The front building has an upper story, containing three spacious rooms, one of which is allotted to the keeper of the museum, and another to the valuable collection of comparative anatomy, the property of the curator of that department, James Atkinson, Esq. The whole of the building, except the basement, is heated by stoves erected by Mr. Haden, of Trowbridge, and Mr. Pickersgill, of York. Preparations are made for lighting the whole with gas. A considerable part of the internal finishings have been executed under the gratuitous direction of Mr. Pritchett.

The basement story contains a laboratory accommodation for the lecturer, immediately communicating with the lecture-room; a dwelling-house for the sub-curator; and a long gallery containing the architectural fragments of the Abbey, discovered in the late excavations. A curious old fire-place, belonging to the Abbey, is preserved in its original position, in one of the basement rooms, and forms a very interesting object to the antiquary. The room being under the hall, is necessarily nearly dark, a gas-light is fixed to throw a feeble light upon this relic, and adds not a little to the interest it excites.

The museum was opened on the 2d February 1830.

Beside these buildings, York contains two well managed lunatic asylums, one of which is the Retreat, founded by a body of men, the quakers, who are ever doing good, and the other erected in 1769; a county hospital, a city dispensary; national schools for children of both sexes; charity schools for the blue coat boys and grey coat girls; a city jail; a bridewell; a subscription library, founded in 1794, and various other meeting houses for Roman catholics, quakers, methodists, presbyterians and independents.

The philosophical society of York was founded a few years ago, and from the knowledge and science of the gentlemen by whom it is patronised and conducted, we have no doubt that while it advances the general interests of science, it will pursue with ardour and success, those local inquiries which are necessary for exploring the natural history and meteorology of the rich and extensive district of which York is the centre.

York carries on a considerable river trade by means of the Ouse, which is navigable as far as the bridge for vessels of 120 tons. Some business is carried on in linens, glass, livery lace, gloves, and drugs.

The race ground has the form of a horse shoe, and is well fitted for its purpose.

The vicinity of York contains many country seats of great beauty and grandeur. About three miles from York stands Bishop Thorpe, the magnificent palace of the archbishop.

The population of the city in 1821 was 3206 houses, 4412 families, 288 engaged in agriculture, 3333 engaged in trade, 9574 males, 11,240 females, and the total number of inhabitants 20,787.

YORKSHIRE, a maritime county on the east coast of England, is bounded on the east by the German ocean, on the north by the counties of Durham and Westmoreland, on the west by a small part of the latter county and by Lancashire, and on the south by the Humber, separating it from Linconshire, and by the counties of Nottingham and Derby. Its extreme length from east to west is 96 miles, its utmost breadth from north to south 86, and its circumference above 380. Its surface has been calculated to extend to 6000 square miles, which is equal to 3,840,000 statute acres, more than double the extent of any other county, and two-thirds of the size of the principality of Wales. During the existence of the property-tax, according to the official returns, the annual rent, including tithes, which land in this county brought, was sixteen shillings and ten pence per acre.

Before we proceed to give a separate account of the three districts (West, East, and North Riding) into which Yorkshire is divided, it seems proper to take a general view of the whole county. The population is the first object that claims our attention. In 1821, the date of the last census, it amounted to 1,173,187, of whom 580,456 were males, and 592,731 females. In 1811, it was 1,019,200, while in 1801, it did not exceed 887,000, making the increase during twenty years to be 286,187, or a little more than the fourth of the whole population. The number of families in 1821 were 240,696, of whom more than the half, or 137,011 were employed in trade, manufactures, or handicraft. The West Riding, it may here be mentioned, exceeds, by 51,697, the population of the other two divisions. The poor rates levied from the whole county are as follows:

West Riding - - - -	£368,547
East Riding - - - -	118,002
North Riding - - - -	100,450
	£586,999;

which sum, when compared with the population, shows that the rates are not so high in Yorkshire, the greatest manufacturing county in the kingdom, as the average of England and Wales united. The select vestries of the county amount to 638; the assistant overseers to 220.

The political circumstances of this county may be stated in a few words. The freeholders of the Ridings vote together, as if no such division existed. Till the year 1824, this large province returned only two members to the British Parliament; but in that year, owing to the disfranchisement of the burgh of Grampound in Cornwall, the elective franchise was transferred to the county under review, which now, of course, can boast of four representatives, while no other shire returns more than two. Yorkshire, including the city of York, and the burghs, sends 32 members to Parliament, as under:

County of York -	4	Malton -	2
City of York -	2	Northallerton -	2
Alderborough -	2	Pontefract -	2
Beverley -	2	Richmond -	2
Boroughbridge -	2	Ripon -	2
Hedon - -	2	Scarborough -	2
Hull - -	2	Thirsk -	2
Knaresborough -	2		
		Total,	32

It may here also be mentioned, that of titles of peers connected with this county, there are two of dukes, namely, those of Richmond and Leeds, (the title of Duke of York till lately formed a third); one of marquis, that of Cleveland; six of earls, Doncaster (Duke of Buccleuch as a Scottish peer); Scarborough, Pomfret, Beverly, Craven, Mulgrave, and Harewood; four of barons, Hawke, Bolton, Ribblesdale, and Proudhoe. These peers derive their titles from this county; and the list of noblemen connected with it by residence is also considerable: Earls—Carlisle, Egremont, Fitzwilliam and Mexborough; Lords—Dundas, Effingham, Grantham, Middleton, and Rendlesham.

The rivers of this county are numerous, and many of them being navigable, are very subservient to the prosperity of the province. All these rivers discharge their waters into the German ocean, except the Ribble and Wenning, which enter Lancashire, and fall into the Irish sea. The Humber, which separates Yorkshire from Lincolnshire, is formed by the junction of the Ouse and the Trent; at the place where the latter river falls into it, it is more than a mile in breadth; its channel gradually widens till it empties itself into the German ocean, between the promontories of Spurnhead and Saltfleet, in a vast estuary, six or seven miles wide. The Trent and Ouse, which form the Humber, themselves receive the waters of many tributary streams. The Trent, however, is not a Yorkshire river, but rising in Staffordshire, flows north till it loses itself in the estuary referred to. The Ouse receives the waters of the Swale, Ure, Nidd, Wharfe, Derwent, Eyre, and Don. It is navigable to the city of York, which it washes; almost all its tributaries are navigable, making the internal communication of the county extremely ample. The Tees, which separates Yorkshire from Durham, on the north, is a considerable river, but it belongs more to the latter county than the former. There are various canals which connect the inland towns and coal mines with the navigable rivers: the most important canal is that which unites Leeds, which is situated on the Eyre, a navigable stream, and Liverpool, thus communicating with the German and Irish seas.

It has already been mentioned that Yorkshire is divided into three districts, the North, East, and West Ridings. There are also inferior divisions, the most important of which are denominated *Wapentakes*, a word synonymous with the term *hundred* in some other counties. As from the size of the county, the Ridings are distinguished by several peculiarities, we shall consider each separately. The West Riding, being the most important, first claims our attention.

This division contains a little more than two-thirds of the whole population of Yorkshire, and nearly one half of the superficial extent. It is divided into nine wapentakes, and is 95 miles in length, from east to west, and above 48 at its greatest breadth, from north to south. Its physical appearance is considerably varied. Towards the east, on the banks of the Ouse, which forms its boundary in that direction, it presents a level and marshy aspect, very fertile, but very uninteresting from its great uniformity. Towards the west it gradually rises, and is beautifully varied, till at length, on the borders of Lancashire and Westmoreland, it becomes rugged, bleak, and mountainous. Indeed some of the highest mountains in England are situated in this corner of Yorkshire, namely, those of Ingleborough, Pennigant, and Whernside; which are, respectively, 2361, 2270, and 2263 feet, above the level of the sea. Amid these lofty mountains there are various fertile and romantic valleys, affording many striking instances of abrupt transitions, and the boldest contrasts. Of this Riding the climate, as might be supposed, is various, being warm and humid on the east, and gradually becoming colder, till it reaches the mountainous tract referred to, at which place the weather has been characterized as the coldest, the most rainy and stormy in England.

In this Riding agriculture has been brought to considerable perfection. The soil embraces every variety, from the most fertile species to the most bleak and barren: indeed the latter is supposed to extend to nearly a fourth part of the whole superficial extent, of which, however, about a half is capable of improvement, and is rapidly undergoing it. The arable lands are, in general, neatly inclosed either with hedges or stone-walls, called *dykes* in Scotland. In various places a species of irrigation, denominated *warping*, has been much practised, and been productive of the most beneficial effects. It consists in overflowing the lands by the water of the river at the highest of the tide, by which means depositions are gradually made on the surface, till a considerable depth of alluvial soil has been obtained, sometimes to the extent of ten or fourteen feet. Lands that have undergone this process not unfrequently yield various successive crops of great value without any application of manure. Wheat is produced in great abundance, more so indeed than any other grain. Oats are also very extensively cultivated; indeed oat-meal, as in Scotland, forms the chief part of the food of the inhabitants throughout all this division, but particularly towards the west of it. Turnips and potatoes are also reared; and of the latter great quantities are sent by water carriage to the London market. Flax is grown in considerable abundance. Rye, peas and beans, are but partially cultivated. Liquorice is produced in great perfection on some deep loamy soils. Teazles, a production used for the purpose of raising the nap on cloth before it is submitted to the operation of the shears, are grown to a considerable extent, and are almost peculiar to this part of the county. A great portion of this Riding is devoted to pasture, and dairies are pretty common. The horned cattle, sheep, and horses have nothing peculiar; the horses for which Yorkshire has become celebrated, are reared mostly in the other two divisions

The mineral wealth of the West Riding must not be overlooked. There are mines of iron, lead, and coal; which last seems almost inexhaustible, but it abounds most between Leeds and Wakefield, and in the vicinity of Barnsley, Bradford and Sheffield. Iron is often found in the same mine with coal; indeed the best strata of coal are found under seams of iron, sometimes of a depth of about 200 feet below the surface.

But whatever be its agriculture and mineral wealth, or its distinction in other respects, the division under review is chiefly eminent for the great extent of its manufactures; in truth it may be pronounced one of the greatest manufacturing districts, not only in England, but in the world. The truth of this assertion will be allowed when we mention Leeds, Wakefield, Huddersfield, Sheffield, Halifax, Bradford; indeed the greater part of the whole division, studded with villages as large as most towns, forms one continued succession of manufacturing establishments. The aggregate number of families amounts to 161,466, of whom 108,841 or two-thirds of the whole population, are employed in trade, manufactures or handicraft. The ample supply of coal; the extent of water carriage, and the command over the most powerful machinery afforded them by the numerous streams with which the Riding abounds, have had no trivial effect in giving that eminence in manufactures to which we are referring. Their manufactures embrace broad and narrow cloths of all kinds, flannels, with every species of woollen goods, shalloons, calimancoes. Sheffield exports cutlery and plated goods to every quarter of the globe. The soil of the manufacturing districts is not naturally good, but owing to the great increase of manufactures, it has been cultivated, so that it is equal, if not superior, to the most fertile districts. During the ten years previously to 1821, while the population of the East Riding increased 14 per cent and that of the North Riding 20 per cent, the increase of the West Riding was no less than 23.

The chief towns are Halifax, including the parish; population 92,850; Leeds, 83,796, Sheffield and parish, 52,105; Bradford and parish, 62,954; Huddersfield and parish, 24,220; Almondbury, 23,979; Kirk-Heaton, 21,870; Birstall, 21,217; Dewesbury, 16,261; Calverley, 14,134; Kirk-Burton, 13,695; Ripon, 13,096; Ecclesfield, 12,496. There are a great many other towns and villages, such as Doncaster, Pontefract and Knaresborough, but none of them contain so many as 10,000 inhabitants.

The East Riding next claims our attention. It is bounded on the east by the German Ocean; on the north and west by the rivers Hartford, Derwent and the Ouse; and south by the Humber. This Riding, which comprehends six wapentakes, and is the smallest of the three divisions of which the county consists, is not marked by any very peculiar features. The wolds, a range of chalky hills elevated above the level country about 600 feet, extends from north to south, nearly through the whole of the Riding. The wolds, till within forty years, remained nearly in a state of nature, being entirely uncultivated, but since that time they have been enclosed and subdivided and subjected to the action of the plough, and now produce excellent crops. The soil is commonly a light loam, with a mixture of chalk. On each side of the wolds extend flat, level, fertile tracts, with gentle undulations, where agriculture has been carried to very considerable perfection. Marshes have been drained, and extensive districts formerly swarming with rabbits, have been converted to a more useful purpose, being used either for grain or pasture. Agriculture has gained no greater triumph in any district in England than it has acquired in the quarter under review, particularly in the successful cultivation of the wolds. Fifty years ago, agriculture, which has recently been brought to such perfection, was in a very rude state, and barley and oats were the principal, if not the only, grain produced. Now not only the valleys, but the slopes of the hills are adorned with wheat; and wheat-bread, and not oatmeal, constitutes the chief food of the people. What twenty years ago was a marshy waste, and could not be crossed with safety, has now the advantage of numerous excellent roads, is studded with elegant farm-houses, and produces the best crops. This division contains also some excellent pasture-grounds. The farms are generally large, each varying from £200 to £1200 per annum of rent. The climate includes every variety of weather; the east winds are cold and raw; the wolds average a very low temperature; the tract on the west of this range is the mildest.

The East Riding can boast of no mineral wealth; nor have manufactures been much cultivated; carpets, spinning of flax and cotton are almost the only articles connected with manufactures which has been attended to. This riding cannot boast of much timber, and it has no coal; which latter article is got either from the mines in the West Riding or from the county of Durham. The produce of agriculture and pasturage form the staple commodities of the people, which they export to a great extent; grain, potatoes, bacon, horses, black cattle, butter, wool, which last article is generally sold to cloth manufacturers in the West Riding. Ship-building, particularly at Hull, is a great source of employment. Hull, indeed, is the great entrepot of the trade and commerce, not only of this Riding and of all Yorkshire, but also to a great extent of the counties of Lancaster, Chester, Derby and Nottingham; in consequence of which that city has more than doubled its population (which is now 31,425) within the last forty years. The whale-fishery on the coast of Greenland has been long prosecuted by the inhabitants of Hull. The herring-fishery is also pursued by several of the coast towns of this Riding.

The chief towns and villages in this division are York, population 38,731; Hull, as just mentioned; Sulcoates, 10,449; Beverley, 7503; Howden, 4443. No other town or burgh contain more than 3000.

The North Riding falls last to be considered. It contains that portion of the county not included in the two divisions already described. It is divided into ten wapentakes. The physical appearance is considerably various: the land on the shore is lofty and precipitous, varying from 150 to 900 feet in height. In several parts of the district, there are considerable elevations, Rosebury-Topping, a mountain whose summit is 1480 feet above the level of the sea, being the highest. Moorlands abound much; but there are some very fertile and extensive, of great beauty and fertility, which form a striking contrast with the elevated and comparatively barren ground with which they are bounded. There are extensive marshes, both on the banks of some of the rivers, particularly the Derwent, and in the other districts. Some of them have recently been drained, and many are in the way of undergoing this amelioration; but still much on this head requires to be done. Mists and humidity, both on these swamps and on the high ground, prevail more than in any of the other divisions of the county. In some of the valleys, the weather in summer is intensely sultry; while in winter, a corresponding degree of cold is felt; and snow abounds, particularly on the moorlands.

Though agriculture has not been neglected, but on the contrary has been practised with great success in some of the richest spots, yet the breeding of cattle and other live stock is carried on to a greater extent here than in the other Ridings. The operations of the dairy are also common. The cows are generally of a small size: the average weight of the oxen is 40 stone. Flocks of sheep are numerous; of which they are rapidly improving the kind by the introduction of better breeds. The fine wool of this division is not exported, but used for the manufacture of hosiery, which the females here cultivate pretty considerably. This Riding has long been celebrated for the rearing of horses, calculated respectively for the draught, the turf, and saddle, and vast numbers of them are purchased at the York and Howden fairs by dealers from London and almost every quarter of the empire. There is also a smaller breed, not unlike the Scottish Shelties and Galloways.

This Riding, like the division last described, can hardly be said to be possessed of any mineral wealth. Lead, iron and copper mines have been wrought to a very small degree. Coal is found, but the quality is bad, and fuel is imported from Durham. Alum is got in considerable quantities, and is the source of considerable wealth. There are no manufactures, except those of linen, knit hose, and gloves, but none of them carried on very extensively.

Of towns and villages the most important are Whitby, population, 12,331; Scarborough, 8533; Northallerton, 4431; Maldon, 4005; Richmond, 3546; Thirsk, 2533.

With regard to antiquities, Yorkshire was inhabited in the time of the Romans by the Brigantes. Eboracum, the present city of York, was the station of the Legio sexta Victrix, where the emperors Severus and Constantius Chlorus died. There are throughout the county many old castellated remains. The ecclesiastical ruins, however, are the most striking, including no fewer than 106 decayed religious houses, namely, 14 abbeys, 44 priories, 7 alien priories, 13 cells, and 28 houses of friars of various orders. (See Dugdale's *Monasticon Anglicanum.*)

This county has produced many eminent men; such as Constantine the Great, Ailred, abbot of Rievall, Wycliffe, Sir George Gower, Sandys the traveller, Sir Robert Stapleton, Garth, Andrew Marvel, Tillotson, Bentley, Captain Cook. We may here mention that a curious biographical sketch of St. Ninian, bishop of Candida Casa, written by Ailred, abbot of Rievall, who lived in the 12th century, forms the first article of a collection of ancient biography, published by Pinkerton, and entitled *Vitae Antiquae Sanctorum, qui habitaverunt in re parte Britanniae, nunc vocata Scotia, vel in ejus Insulas.* Lond. 1789, 8vo.

See Bigland's *Beauties of England and Wales;* Hargrove's *Yorkshire Gazetteer;* Langdale's *Yorkshire Topography;* and the various *Agricultural Surveys,* by Tuke, Brown, Latham, and others. See also in this work, the articles YORK, WAKEFIELD, and the other important towns of this county. (T. M.)

STATE OF NEW YORK.

YORK, New, one of the United States of North America, bounded N.E. by Vermont, E. by Massachusetts, S.E. by Connecticut, S.W. by New Jersey, S. by Pennsylvania, W. by Lake Erie, Niagara river, and Lake Ontario, N.W. by St. Lawrence river, and N. by Huntingdon county, in Lower Canada.

	Miles.
This state has an outline, commencing at the southern point of Staten Island, and from thence up Staten Island Sound and Hudson river to the extreme northeastern angle of New Jersey	45
Along the northeastern border of New Jersey to Delaware river, at the mouth of Neversink creek	45
Up Delaware river opposite Pennsylvania	65
Thence west along the northern boundary of Pennsylvania	225
Thence due N. to Lake Erie	19
Down Lake Erie to the head of Niagara river	66
Down Niagara river to Lake Ontario	35
Along the south shore of Lake Ontario to the head of St. Lawrence river	200
Down St. Lawrence river to N. Lat. 45°	100
Upon N. Lat. 45° to Lake Champlain	65
Up Lake Champlain to Whitehall, at the junction of Wood creek with Pultney river	105
Up Pultney river along Vermont	10
Thence along W. boundary of Vermont	54
Thence E. along S. boundary of Vermont	3
Thence along the W. boundary of Massachusetts	50
Thence E. along S. boundary of Massachusetts	2
Thence along W. boundary of Connecticut to the mouth of Bryan river	81
Around Long Island	230
Having an entire outline of	1400

From its great outline presenting so many entering and re-entering angles, to determine the area of New York is a problem of difficult solution. The area has been estimated from 45,000 to 48,000 square miles; the estimate is generally made too low, but if we make allowance for mountainous and other uncultivatable tracts, New York contains about 46,000 square miles of arable land. Nature has superinduced divisions into three sections: southern, northern, and western, but in taking the census of 1830, the state was divided into the two following political sections:—

Abstract of the returns of the counties, with their respective population, in 1830.

Southern District.

N. Y. city & c'y	202,589	Kings	20,535
Putnam	12,628	Richmond	7,082
Rockland	9,388	Ulster*	36,550
Suffolk	26,780	Columbia	39,907
Sullivan	12,364	Orange	45,366
Greene	29,525	Queens	22,460
Westchester	36,456	Dutchess	50,926
	329,730		222,826
			329,730
		Total	552,556

Northern District.

Alleghany	26,276	Montgomery†	43,715
Albany	53,520	Niagara	18,482
Broome	17,579	Orleans	17,732
Cataraugus	16,724	Ontario	40,288
Clinton	19,344	Oswego	27,119
Courtland	23,791	Otsego	51,372
Cayuga	47,948	Oneida	71,326
Chenango	37,238	Onondaga	58,973
Chautauque	34,671	Rensselaer	49,424
Delaware	33,024	Schoharie	27,902
Essex	19,237	Schenectady	12,347
Erie	35,719	Saratoga	38,679
Franklin	11,312	St. Lawrence	36,354
Genesee	52,147	Steuben	33,851
Herkimer	35,870	Seneca	21,041
Hamilton†	1,325	Tioga	27,690
Jefferson	48,493	Tompkins	36,545
Lewis	15,239	Wayne	33,643
Livingston	27,729	Washington	42,635
Madison	39,038	Warren	11,796
Monroe	49,855	Yates	19,009
	646,129		719,923
			646,129
			1,366,052
		Southern District	552,556
		Grand Total	1,918,608

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* This includes the paupers in the Alms-house at New Peltz.

† In the year 1816, an act was passed by the legislature, establishing Hamilton county, but it is to remain united with Montgomery until it contains 1288 taxable inhabitants.

Recapitulation of the Population of the State in 1830, *showing the classification of the inhabitants.*

WHITES.

AGE	MALES	FEMALES
Under 5 Yrs.	158 077	151,868
5 to 10	137,071	133,084
10 to 15	118,523	115,166
15 to 20	101,712	105.196
20 to 30	176,754	168,897
30 to 40	113,136	104,522
40 to 50	68,871	64,315
50 to 60	40,503	38,344
60 to 70	23,909	22,589
70 to 80	10,034	9,645
80 to 90	2,561	2,673
90 to 100	255	304
100 & upw.	35	17
	951 441	916,620
		951,441
Total White Pop.		1868,061

COLOURED.

AGE	MALES	FEMALES
Un. 10 Yrs.	5,647	5,532
10 to 20	6,102	6,855
20 to 36	4,859	5,521
36 to 55	3,493	3,783
55 to 100	1,357	1,720
100 & upwds.	19	57
	21,477	23,468
		21,477
Total Col. Pop.		44,945

Of these 76 are returned as Slaves, viz.

City New York	17
Putnam County	4
Albany	2
Chenango	3
Montgomery	26
Oneida	15
Washington	8
Uncertain	1

Total Whites		1,868,061
Total Classed		1,913,006
Aliens, &c. in 9th ward City of New York not classed		5,477
Alms-house, New Peltz, Ulster County, males 75 females 50		125
Grand Total		1,918,608

Included in the foregoing

Deaf and Dumb	Whites	842	
	Coloured	43	
			885
Blind	Whites	642	
	Coloured	82	
			724

Aliens or foreigners not naturalized 52,488

Population of Cities in 1830.

New York	202,589
Albany	24,209
Hudson	5,392
Schenectady	4,268
Troy	11,556

Principal Villages.

Brooklyn	12,406
Buffaloe	6,321
Poughkeepsie	5,023
Rochester	9,269
Utica	8,323

Besides the preceding there are numerous villages scattered over the state, containing from 1000 to 3000 inhabitants. Commercially Brooklyn ought to be regarded as a part of New York, presenting a city containing 214,995 inhabitants.

If we allow the state 46,000 square miles, we have from the preceding table a distributive population of 41.71 to the square mile, approaching in density and aggregate amount the population of many of the smaller kingdoms of central Europe.

History and Civil Government.—The mouth of the Hudson river was probably one of the first places reached by European navigators on the coast of North America; but no well authenticated instance of actual settlement took place until 1609 or 1610. The Dutch, who made the discovery and settlement, entered seriously on their project of colonization, and in 1621 the states general of the Dutch republic gave the country the name of New Netherlands, and granted its government to the Dutch West India Company. The New Netherlands embraced New York, Long Island, New Jersey, and both banks of the Delaware. The city of New Amsterdam, now New York, continued the capital until 1664, when the whole country was conquered by the English. Charles II. granted this province and adjacent parts to his brother James, Duke of York, under the name of New York. After much oppression under the dukes' governors, a legislative assembly was formed in 1683, and the powers of the people augmented and secured by a bill of rights soon after the revolution in 1688.

New York soon became a colony of considerable consequence, but her subsequent history up to the revolution in 1775, was barren of events of much consequence. Previous, however, to the overt act of resistance, the people of New York, had been made ready for opposition to any length by individual oppression. With other colonies they resisted the stamp act of 1765, and in 1767 was by royal authority restrained from legislation, until quarters were provided for British troops. This impolitic and unjust imposition of burthening the people with soldiers in time of peace, was one of the most operative causes of the revolution, and in the case of New York, was aggravated by all the insolence of power. The consequence of such measures was to add the colony to the continental confederacy. The city of New York was early in the war seized by the British, and held by them until November 25, 1783.

Some of the most memorable events of the war occurred in New York, particularly the capture of General Burgoyne and his army, October 1777, a year rendered still more interesting in her annals by the adoption, on the 20th of April, of a republican constitution. This instrument was amended October 27th, 1801, and was superseded by a new constitution, adopted at Albany on the 10th November 1821, the general provisions of which do not materially differ from those of other states.

By this constitution the legislative power is vested in a senate and an assembly. The senate consists of thirty-two members, who are required to be free-holders; they are elected for four years, the seats of one-fourth being vacated annually. The assembly is composed of 128 members, all of whom are annually elected.

The executive power is vested in a governor, who is elected for two years; he must be a freeholder, and have attained the age of thirty-five years. It is requisite also that he shall be a *native* citizen of the United States, and have resided five years in the state, unless during that period he shall have been absent on public business of the state, or of the United States. The governor has the power of pardon in all cases of conviction, except for treason and on impeachments: in case of treason he can suspend the execution of the sentence until the decision of the next session of the legislature. The lieutenant-governor is elected at the same time and for the same period as the governor, and in case of vacancies in the latter office, its duties are performed by the lieutenant-governor.

CLIMATE.—In the article UNITED STATES, in this volume, page 289—307, the reader will find the general principles of the climate of the entire physical section of our continent, including New York. The writer of this article has travelled over nearly every part of New York, with the express view of examining the prevailing winds, the real controling cause of every climate. In the western part of the state, so powerful and so constant are the western winds, that the entire forests are bent eastward to an extent to arrest the attention of every observer. Extending through 4½ degrees of latitude, a very perceptible difference of temperature exists between the extremes arising from mere difference of equatorial distance, but the intermediate mountains operate to increase the real extreme of temperature. The winters are long and severe at Albany, N. Lat. 42° 39′, and still more intense advancing northwestward from that city.

Similar to all surfaces so large and broken, any general character given to its climate must be subject to so many local exceptions as to admit but little precision. Of the aeriel temperature over New York, we can only, therefore, say, that along the ocean border, it is subject to less severity of cold than even a few miles inland, but that the winters are in most years severe. The mercury has fallen at Albany to 18 degrees below zero. The rivers are annually and permanently frozen from two to three months.

PHYSICAL FEATURES.—It would be difficult to conceive a species of soil or feature in nature not to be found in or on the border of New York. In giving a summary of the physiognomy of the United States (see page 261, &c.), so much has been said on the geography of New York, as very much to abridge what would otherwise have been necessary in the present article: it may suffice to observe that the state rises from the Atlantic ocean, by a long insular sea border, to which the name of Long Island has been given; through this selvage the Atlantic tides are borne inland, upwards of 150 miles, and passing numerous chains of mountains, reach the interior secondary formation. On each side of this natural channel the country rises into mountains, of from 500 to 4000 feet, with extensive valleys of productive soil, and cultivated by an active people. Passing the tide channel and the mountainous region, the face of the earth becomes less imposing and stern, and the soil more fertile towards the west, but less so northward, from the Hudson and Mohawk rivers. Comparatively the rather elevated tract north from the Mohawk, and west from Lakes George and Champlain, is a cold and sterile expanse remaining much the most thinly peopled part of the state.

The State of New York may be fairly deemed the travelling ground of the United States. The city itself, the majestic Hudson, the canal and the great western country, the Niagara, Trenton, and Cahoes falls; Saratoga, Ballston, Lebanon and Avon Springs, the Catskill mountains, all these present a combination of interesting objects which amply repay the curiosity of the enlightened traveller. The many scenes, too, connected with the revolutionary war and the war of 1812, cannot fail to arouse patriotic feelings, as the village of Tarry-Town, Saratoga, Plattsburgh, and the noble and romantic scenery of West Point, with its admirable institution for military science.

MINERAL SPRINGS.—Several of the mineral waters of this state have been long known, and annually arrest the attention of the valetudinarian. Those most resorted to for remedial purposes are the Ballston and Saratoga waters, in Saratoga county, and the Avon springs in Livingston county.

The waters at Ballston and Saratoga have been long known. In 1793, an imperfect account of them was published. The Sans Souci Spring, at Ballston, contains a sparkling and acidulous water, of a highly chalybeate taste, and somewhat saline. According to Steel's Analysis, one gallon, or 231 cubic inches of the water from this spring, contains chloride of sodium 143.733.—Bicarbonate of soda 12.66.—Bicarbonate of magnesia 39.1.—Carbonate of lime 43.407.—Carbonate of iron 5.95.—Hydriodate of soda 1.3.—Silex 1.—Solid contents in a gallon 247.15 grs. The famous Congress Spring at Saratoga contains cholide of sodium 385.0—Hydriodate of soda 3.5.—Bicarbonate of soda 8.982.—Bicarbonate of magnesia 95.788.—Carbonate of lime 98.098.—Carbonate of iron 5.075.—Silex 1.5. Hydro-bromate of potash, a trace—total 597.943 grains: carbonic acid gas 311.—Atmospheric air 7.—Gaseous contents 318 cubic inches. The medical qualities of these waters strongly recommend themselves as serviceable in a considerable variety of disorders; and several American writers have written expressly on the subject of their great importance in different affections of the digestive organs, cutaneous diseases, constitutional vitiations, &c. &c. (See Hosack, on the Mineral Waters of Ballston. Steele's Analysis, &c.) Inasmuch, however, as these waters are so universally known and appreciated, it will be unnecessary in this place to say more respecting them.

The Avon Springs are conspicuous among the mineral waters of the State of New York. They are situate in Livingston county, within less than a mile of the village of Avon. They at present comprise two springs within about 42 rods of each other, and somewhat less than one-third of a mile from the Genessee river; they issue from the foot or base of the high lands that border its flats or low grounds. They are denominated the lower and the upper springs; the former has been for several years known: the latter is but recently discovered, and is preferred by some. Dr. Hadley has lately published an analysis of this spring, which seems to have been made with much accuracy. According to his analysis, one gallon of the water contains, carbonic acid 5.6 cubic inches, sulphurated hydrogen gas, 12 cubic inches, carbonate of lime, 8 grs, sulphate of lime 84 grs, sulphate of magnesia 20 grs, muriate of soda, 16 grs, sulphate of soda 18.4 grs, and a small quantity of the other muriates. According to Dr. Salisbury, the lower spring, the first discovered, yielded to a pint of water, sulphurated hydrogen, 3 cubic inches, carbonate of lime 1 grain, sulphate of lime 16 grs, muriate of magnesia, 5.8 grs, sulphate of magnesia, 1.75 grs, muriate of soda, 3.28 grs. A recent minute analysis of both these waters lately instituted by Professor J. W. Francis of New York, has not evinced that either contains iodine in combination. Their low temperature also deserves to be noticed.

The value of these waters has within the past two or three years induced many visitors to partake of them. They may be ranked among the most powerful and remedial waters yet made known; but like all other medicinal agents of a similar character, they are capable of abuse, and in certain states of the system, may prove injurious. Possessing active emetic and cathartic properties, particularly the waters of the spring last discovered, it is requisite that caution be exercised, not to indulge in them too freely at first; and as they are more or less exciting, they also demand that previous to beginning their use, the system should, in many cases at least, be first relieved by the employment of some efficient cathartic. In disorders of the digestive organs, arising from torpor of the primæ vitæ, hepatic obstructions and affections of the glandular system, in rheumatism and gout, and in many of the most formidable of cutaneous affections, these waters have secured the confidence of those who had previously suffered to the severest degree from those maladies. In pulmonary disorders, their administration is to be regulated by the nicest precepts of the healing art, inasmuch as these waters are eminently calculated to produce powerful changes on the system, by their active operation. According to Professor Francis, who has for several years recommended these waters, they have proved available in several of the severest cases of rheumatic gout, and in some affections of the urinary organs. After the use of these waters for but a few days, the appetite is greatly improved, and the general health, now invigorated, receives the impress and partakes of all the advantages of increased physical energy and mental vigour. When internally taken, these waters prove cathartic, diuretic, diaphoretic and tonic. When used for bathing, at the temperature of 95° or 98°, they act as a most salutary detersive in cutaneous complaints.

Onondaga Salt Springs. These springs are situated in the town of Salina, Onondaga county, and are the property of the state.

The salt is manufactured at four different villages viz: Salina, Syracuse, Geddes and Liverpool, but much the larger quantity is made at Salina; the state receives from the manufacturers a duty of 12½ cents per bushel for the benefit of the canal fund.

Quantity inspected in	1826,	827,508 bushels.
	1827,	983,410
	1828,	1,160,888
	1829,	1,291,280
	1830,	1,435,446
	1831,	1,514,037

The nett revenue derived from salt duties by the state, from 1817 to 1831 inclusive, is about $1,400,000.

For a particular account of these springs, and those of Cayuga county, see our article SALT, Vol. XVI. p. 556—558.

EDUCATION.—Though not the first among the states of the confederacy to introduce the system of universal education, New York may, with some truth, be said to have surpassed all the other states, in the liberality, as well as the sound policy of her provisions for its maintenance. She has happily taken the due mean between relying wholly upon taxation on the one hand, and upon accumulated funds on the other, for the support of schools throughout her community. She has avoided the error of applying all her legislation to a single class of institutions; thus showing a spirit above the petty jealousy that would annihilate the higher, and a sense and patriotism that imperatively forbade her to neglect the lower seminaries of learning. We do not find colleges and universities multiplied till one actually devours another, while the mass of the community is without even the ordinary rudiments of knowledge; nor do we perceive, on the contrary, the avenues to classical attainments so hedged about by the expensiveness, the useless requisitions and the forbidding ceremonials which might appal the youth whose *treasures were only of the mind*, from attempting to gain the station in society for which his natural endowments had qualified him.

There does not appear any ostentatious display of extravagance in her expenditures for education,—nor any of that niggardly parsimony which would compel the people to buy a cheap commodity of learning, sure at the same time that it must be a *poor* one.

She has not hesitated, while prosecuting the most magnificent schemes for improving the value of her physical resources, to devise and execute plans far more magnificent for the development of her intellectual treasures. It has not been the spirit of her measures to consign a whole generation *now existing* to brutish ignorance, in order that the *next* might riot on its earnings, and sink in the same manner into oblivion, without having been provided with means of any rational enlargement of the most ennobling faculties. She has not been terrified by the fear that the coming age, which is to be the heir of her noble heritage of knowledge, freedom and moral power, should be compelled to pay out of its immense resources, a few of the millions by which that heritage was originally obtained. She has perceived it to be sound policy to incur a *debt*, when the transaction is sure to multiply a hundred fold the power of repaying it. The system of internal improvements, instead of absorbing and annihilating those very resources which are wanted to sustain public spirit and intelligence, by means of education, is, in New York, made to minister directly and effectually to that object, and thus to react in producing again the foresight and discernment which were alone requisite to understand the utility of those improvements, even before they had an existence.

Origin of the System. The foundation of a system of common schools was laid in this state nearly forty years ago. The first act to that effect was passed April 9, 1795, appropriating out of the annual revenues of the state, twenty thousand pounds annually for five years, for the purpose of encouraging and maintaining schools in the several cities and towns in the state. The several counties were required to raise a sum equal to one half of that appropriated to each by the state. At the expiration of this law in 1800, the legislature refused to renew it; but in 1805, impelled, probably, by a sense of the deprivation under which the state laboured, in being again thrown back upon voluntary individual or local efforts, the legislature passed an act, providing that the nett proceeds of five hundred thousand acres of vacant and unappropriated public lands should be applied to form a permanent fund for the support of common schools. In the same year, three thousand shares of bank stock were ordered to be subscribed by the state, and to belong to the school fund. No part of this fund was to be applied to its ultimate object, until the interest should amount to fifty thousand dollars annually.

In 1811 measures were taken to organize and establish in active force a system of schools; such a system was *reported* in 1812, and the first distribution of money under the provisions of 1805, and in accordance with this system, were made in the year 1816. Besides the avails of the lands and of the bank stock above-mentioned, the legislature enacted in 1819, that one half the amount to be received from *quit rents*; the *loans* of 1790 and of 1808; the *shares* of the capital stock of the merchant's bank, held by the state; the nett proceeds of *lands escheating* to the state in the military tract, and the nett proceeds of the *fees* of the clerks of the supreme court, should all be assigned to this fund. In 1824 a reservation in certain grants for lotteries, amounting to forty thousand dollars, was added to the fund. In 1826 it was enacted that one hundred thousand dollars should be annually distributed by the state for the support of common schools; but as the fund then produced but eighty-five thousand dollars, the remaining fifteen thousand dollars were paid from the general funds of the state. In 1827 further appropriations, to make up the full amount of one hundred thousand dollars, were made from the state loan of 1786, and from the bank stock still held by the state. These two items amounted to one hundred and thirty-three thousand six hundred and sixteen dollars.

In the same year the credit of the state was pledged in certificates of stock to a canal company (the Hudson and Delaware), which certificates were to be sold, and the premiums obtained added to the school fund; this transaction produced fifty thousand dollars; and finally, a large number of town lots at Oswego, amounting to ninety-one thousand three hundred and forty-nine dollars, were sold in the same year, and the proceeds, together with all the sums obtained from the above-mentioned sources, swelled the productive capital at the beginning of 1828 to one million six hundred and thirty thousand eight hundred and ninety-five dollars. The *constitution of the state* provides that the proceeds of all lands which shall be hereafter sold or disposed of shall belong to the fund for the support of common schools. In 1830 these lands consisted of eight hundred and sixty-nine thousand, one hundred and seventy-eight acres, estimated at half a million of dollars, which, added to the productive capital, makes two millions one hundred and thirty thousand, eight hundred and twenty-five dollars. Besides the general fund of the state, there are likewise several local funds arising out of certain reserved lands in the respective counties. More than eighty towns are stated to participate in the benefit of these funds, amounting to the sum of about seventeen thousand dollars annually.

Progress of the System. The first distribution of public moneys out of the fund was made, as we have said, in 1816, and not till then can the system be said to have gone into actual operation. An estimate may be formed of the influence of this system by comparing the state of things before the funds became available with that which has existed since. In sixteen counties in which the state of schools was reported in 1798, the number of schools was then one thousand three hundred and fifty-two, and of scholars fifty-nine thousand six hundred and sixty. In the *same counties*, in 1828, the number of school districts established was two thousand five hundred and eighty-six, and of scholars attending them, one hundred and forty-two thousand three hundred and seventy-two. Even this comparison falls far short of exhibiting the actual increase of schools and of pupils throughout the state, for in 1798 there were in all but twenty-three counties organized, and therefore only seven which did not report. But in 1828, there were fifty-five counties, divided into seven hundred and forty-two towns and wards, and eight thousand two hundred and ninety-eight school districts, containing four hundred and forty-one thousand eight hundred and fifty-six children. It is true, there are other causes besides the inherent efficacy of the system, which should be regarded in accounting for the rapid increase of schools and pupils. The new counties formed subsequently to 1798, were settled chiefly by emigrants from New-England, who brought with them, as an essential part of their existence, a habit of regarding *universal education in common public schools*, as among the primary objects for which *laws* are to be enacted. And when the system had been once established, it is easy to see that its operation upon the minds of new companies of such emigrants, must be to determine them to select the state which had made this munificent provision for that, which they consider as one of the first wants of their nature, to be their permanent abode; in preference to another, where no such allurement was held out, whatever might otherwise be the physical superiority of the latter. Thus we see, that the system of common schools has reacted, in turn, in favour of population, and consequently in favour of wealth and of power, physical, moral and political.

A Comparative View of the Returns of Common Schools, from 1816 *to* 1832, *inclusive.*

The year in which the report was made to the Legislature.	Number of towns from which the returns were made.	Whole number of school districts in the said towns.	No. of school districts from which returns were received.	Amount of public moneys received in said towns.	Number of children taught in the school districts making returns.	* No. of children between 5 and 15 years of age, residing in those districts.	Proportion of the number of children taught, to the number of children reported between the age of 5 and 15 years.
1816	338	2755	2631	$55,720 98	140106	176449	4 to 15
1817	355	3713	2873	64,834 88	170385	198440	6 to 7
1818	374	3264	3228	73,235 42	183253	218969	5 to 6
1819	402	4614	3844	93,010 54	210316	235871	8 to 9
1820	515	5763	5118	117,151 07	271877	302703	9 to 10
1821	545	6332	5489	146,418 08	304559	317633	24 to 25
1822	611	6659	5882	157,195 04	332977	339258	42 to 43
1823	649	7051	6255	173,420 60	351173	357029	44 to 45
1824	656	7382	6705	182,820 25	377034	373208	94 to 93
1825	698	7642	6876	182,741 61	402940	383500	101 to 96
1826	700	7773	7117	182,790 09	425586	395586	100 to 93
1827	721	8114	7550	185,720 46	431601	411256	21 to 20
1828	742	8298	7806	222,995 77	441856	419216	96 to 91
1829	757	8609	8164	232,343 21	468205	449113	47 to 45
1830	773	8872	8292	214,840 14	480041	468257	48 to 47
1831	785	9063	8631	238,641 36	499424	497503	50 to 49
1832	793	9339	8841	244,998 85	507105	509967	1 to 1

The above table exhibits only the amount of money paid out of the funds, and so much as the authority of the state imposes on the towns, to be raised by them, in consideration of their receiving those funds, which is an *equal sum.* The several school districts have besides the authority to levy a certain proportional sum, about double, it is believed, of that derived from the fund.

But this, which makes in all four times the amount distributed from the fund, does not show the total expenditure on this noble object of legislative provision.

It was estimated at the beginning of the present year (1832), that in the nine thousand and fifty-four districts where schools are supported, that two hundred dollars each are invested, on an average, in *school-houses.* This gives a total of one million eight hundred and ten thousand eight hundred dollars, which, together with one hundred and seventy thousand dollars invested in the same way in the city of New York, gives a total of one million nine hundred and eighty thousand dollars, vested in school houses, which, at an interest of six per cent per annum, would be

	$118,848
Annual expense of books for 506,887, at 50 cents each,	253,443
Fuel for 9054 schools, at $10 each	90,540
Amount of public money for teachers' wages,	244,886
Amount paid for teachers' wages, besides public money,	372,692
	1,080,409

showing the present annual expenditure of the citizens of this state, for the support of common schools, to be one million and eighty thousand dollars, and proving that the application of one hundred thousand dollars out of the fund, induces them to raise voluntarily more than nine times the same amount for the same object.

Police of the System. This exists in the hands of one *superintendent* of common schools, who is likewise the secretary of the commonwealth; fifty-five *clerks of counties;* the *commissioners* of about seven hundred and ninety towns, and the *trustees* of nine thousand school districts.

These several agents are in regular subordination to each other, and, in succession, receive and distribute the funds appropriated by the state for the support of schools. The highest officer, the *superintendent,* is made directly amenable to public opinion, as well as to the law, in being required to present to the legislature annually, in the month of January, a report containing:—

"1. A statement of the condition of the common schools of the state.

"2. Estimates and accounts of expenditures of the school moneys.

"3. Plans for the improvement and management of the common school fund, and for the better organization of the common schools.

"4. All such matters relating to his office, and to the common schools, as he shall deem expedient to communicate."

The collection of documents already issued under this requisition, contains a most useful and instructive mass of facts, which ought to be in the hands of every state legislator in the union. It may be observed, that the police of the general system is not applied in the city of New York, where, instead of commissioners of towns and trustees of the schools, *chosen by the people,* the disbursement of the public money is entrusted to a company, called the "Public School Society." The reason or necessity of this difference of organization has never, to our knowledge, been made evident.

Under article "*Education in the United States,*" will be found a view of the colleges and a statement of the number of academies in New York, to which the reader is referred.

In 1832 the number of academies had risen to fifty-nine, and the number of pupils was four thousand eight hundred and eighty-eight, or seventy-one to each academy. In addition to the means for supporting common schools, the state has another extensive fund, called the *literature fund,* under the management of the "*Regents of the University,*" to which one hundred and fifty thousand dollars was added in 1827, the income of which was required to be distributed to the several incorporated academies and seminaries in proportion to their numbers of pupils. It is gratifying to observe, that a liberal spirit has been manifested in furnishing to these institutions various means and implements for cultivating the natural sciences, and that some of them have already become useful to science by their application of these means. We may refer particularly to the numerous sets of meteorological observations occasionally published by the "Regents," and which are all made at the academies under their charge. The money appropriated to these institutions, has been thus applied with a view of converting them into nurseries of *teachers* for the common schools.

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* The returns of the last three years embrace the number of children over *five* and under *sixteen* years of age.

As the latter are generally taught but a part of the year, that is, on an average, not more than eight months, and as the teachers will generally be otherwise engaged for a portion of their time, and will not be permanently devoted to the business, it is highly important that the greatest possible number of intelligent men should be found in every precinct, capable of understanding the duties, if not of performing the labours, of teachers. In a community thus fully supplied with intelligent members, and impressed with the value of thorough instruction, dulness and mediocrity will seldom find encouragement to usurp the office and responsibility of guiding the intellectual pursuits of the young; while the agents entrusted with the execution of the laws on education will hesitate before they "lay careless hands on skulls that cannot teach, and will not learn."

Canals.—In our article Navigation Inland, Vol. XIV. p. 345 to 373, we have given a full account of the commencement and progress of those great state works, the Erie and Champlain canals: since the publication of that article, these canals have been completed, and are now in successful operation, realizing all the advantages which were anticipated by their projectors; 280 miles of the Erie canal were completed, and the first boat entered the Hudson at Albany, from the north and west, through this canal, on the 8th of October 1823, and the whole line was completed in October 1825.

The length from Lake Erie to the Hudson river is 363 miles, viz.

	miles.	locks.	
Western section; Buffaloe to Montezuma, on Seneca river,	157	21	fall 186 ft.
Middle section; Montezuma to Utica,	96	11	rise & fall 95 ft.
Eastern section; Utica to Albany,	110	52	fall 417
	363	84	rise & fall 698

The whole cost was $9,027,456 05. Tolls in 1830, $954,328 05. In 1831, $1,091,714 26.

Champlain Canal.

Length from Lake Champlain, at White Hall, to Albany, seventy-two miles.

7 locks.	Rise fm. lake to summit lev.	54 ft.
14 do.	Fall fm. sum. lev. to Hudson	134
21 locks.	Rise and fall	186 ft.

The cost of this canal was $1,179,871 95, and the tolls in 1830, $78,148 63; in 1831, $102,896 23.

The Oswego canal connects Lake Ontario with the Erie canal; the length from Salina to Oswego is thirty-eight miles. One half the distance is canal, and one-half slack water, or river navigation, with a towing path on the bank; the descent from Salina to Lake Ontario is 123 feet, and has 14 locks.

The cost of this canal was $525,115 37. Tolls in 1830, $12,335 18, in 1831, 16,271 10.

The Cayuga and Seneca canal from Geneva on the Seneca lake, to Montezuma on the Erie canal, is twenty miles and forty-four chains. One-half canal and one-half slack water navigation; there are eleven locks, and the descent is 73½ feet.

Whole cost $214,000 31. Tolls in 1830, $11,987 81. In 1831, $12,920 39.

For a more detailed account of these and other canals of this state, we refer to our article United States, pp. 275 and 276 of this volume, and for a comparative monthly statement of tolls, see page 280. See also tables XIV. and XVI. pp. 270, 271, for ascents and descents.

Lakes and Rivers.—The principal lakes of New York are Lake Ontario, Lake Erie, Lake Champlain, and Lake George. The three first of these lakes have been all described under Canada, Vol. V. p. 233, 234. Lake George, connected with Lake Champlain, is wholly within this state. It is about thirty-five miles long, and from one to three broad, and is deep and transparent, abounding with fish. Its outlet into Lake Champlain is only three miles, with a descent of 100 feet.

The principal rivers are the Mohawk, the Saranac, the Oswegatche, the Racket, the St. Regis, the Black River, Genesee River, and Onondaga River. The last of these rivers, and the streams connected with it, present a curious combination of lakes and rivers. The lakes which it forms are Oneida, 22 miles long and 5 or 6 broad. Canandaigua, 16 miles long and 1 broad. Crooked Lake, 20 miles long and 1½ broad. Cayuga Lake, 36 miles long and 2 broad, and Owasco Lake, 11 miles long and 1 broad. These lakes, except Oneida, lie in a north and south direction. They are very picturesque, and, from being navigable and well stored with fish, are of great importance.

Manufactures.—The manufactures of this state are numerous and flourishing; they include a large portion of all the necessaries, and many of the luxuries of civilized life. But of all subjects of statistical inquiry, this is the most difficult to arrive at any thing like a correct estimate, the elements being so widely scattered. By the state census of 1825, the number of manufactories were as follows:—

Woollen manufactures	189
Cotton	76
Cotton and Woollen factories	28
Carding Machines	1584
Fulling Mills	1222
Grist Mills	2264
Saw Mills	5195
Oil Mills	121
Iron Works	170
Trip Hammers	164
Distilleries	1129
Asheries	2105

and there had been manufactured in private families the preceding year

2,918,233 yards fulled cloth, valued at $1 per yard	$2,918,233
3,468,001 yards flannel and other woollen cloths not fulled at 20 cts. per yd.	693,600
8,079,992 yards linen, cotton and other cloths, at 15 cents per yard	1,211,998
	$4,823,831

From more recent information, we subjoin the following statement, which will give some idea of the amount of the principal manufactures of the state at the present time (1832).

208 woollen manufactures[*] .	$2,500,000
112 cotton do. . .	3,345,250
6 manufactures of cotton machinery capable of making annually 18,500 spindles, with their appendages, valued at	185,000
10 paper manufactures . .	700,000
10 window glass manufactures .	200,000
Iron do. . .	3,237,390
Leather do. . .	3,458,650
Hats do. . .	3,500,000
Boots and shoes, deducting leather	3,000,000
Value of articles manufactured in families, as before stated, but no doubt greatly increased in amount since 1825	4,823,831
Total	$24,950,121

General Observations.—It has been observed, that the City of New York has, for above a century and a-half, maintained its relative population with that of the state, at about one-tenth. I have heard the position contended for, that as the widely spread and abundant interior resources were developed, that comparatively, the city must decline; and similar calculations have been made in regard to Philadelphia. In both cases events have disproved such estimates; and when the true causes of progressive increase of population are examined, we are fully justified in predicting, that the inhabitants of these two emporia will continue to rather exceed than fall short of one-tenth of their respective states.

The state of New York contains above twenty-nine million statute acres, and at this time (August 1832) at least two millions of inhabitants. There is therefore, fourteen and a-half acres to each individual; and this on a space where five fold the population can be easily and comfortably supported. There is no hazard in assigning ten millions of people to this state. The preceding observations will gain force by the subjoined tabular view of the state and city of New York.

	State.	City.
1790	340,120	33,131
1800	586,756	60,481
1810	959,049	96,373
1820	1,372,812	123,706
1830	1,918,608	202,589

By an examination of this table, it will be found, that in the decimal period between 1820 and 1830, the state of New York gained upwards of 39$\frac{3}{4}$ per cent, and that during the same period the city has increased a small fraction more than 63$\frac{3}{4}$ per cent.

No human mind would have dared a prediction of such increments in either case, and yet in all human probability the now passing period will more than realize an equal increase. If, however, we adopt twenty-five years as necessary to double the population of New York, setting out from 1830, the result will be,

In 1845	2,937,216	inhabitants
1870	5,874,432	"
1895	11,748,864	"

The actual ratio from 1790 to 1830, or during 40 years, was 5.64, which, if continued to 1870, or through the next forty years, would give the state 10,820,949. This latter estimate is far most probable to be realized, and before a century closes on the history of the American revolution, there is little doubt but that New York will sustain a population exceeding ten millions.

[In preparing this Article, we have been indebted for the account of *Mineral Springs* to Professor J. W. Francis, of New York; and for the article on *Education*, to Professor W. R. Johnson, of Philadelphia. W. Darby has, as usual, furnished the Geographical matter.—For much valuable statistical information relative to this important state, see *Williams's New York Annual Register*, a work eminently deserving of encouragement.—Editor.]

CITY OF NEW YORK.

YORK, New, the chief city of the state of New York, and the most populous and commercial town in the United States. It is situate on York Island, at the confluence of Hudson and East rivers, in Lat. 40° 42′ 45″ N. and 74° 4′ W. Long. from Greenwich: or 3° 14′ 15″ E. from the city of Washington.

The island is essentially primitive, and consists mainly of one formation, gneis. It is about fourteen and a-half miles long from N. to S., and varying in breadth from half a mile to nearly two miles, comprehending about twenty-one and a-half square miles. The limits of the city and county are the same, and the only legal sub-divisions are the wards, at present fifteen in number. It is separated on the north from the continental part of the state by Hærlaem river; from New Jersey on the west by the river Hudson; from Staten Island on the south by the bay or harbour; and by the East river from Long Island.

The city of New York was originally settled by the Dutch, in 1614, and its progress has been, since the revolutionary war, rapid beyond precedent, in numbers, wealth, commerce and improvements.

According to the researches of a writer[†] on American antiquities, Henry Hudson arrived at the Island of Manhatten (York Island), called by the natives *Manhadoes* on the 4th of September 1609, then occupied by a ferocious tribe of Indians; he navigated as high as Albany, and on his return to Holland transferred his right of discovery to the Dutch, who afterwards granted it to their West India Company. The latter, the next year, sent ships to Manhatten, to trade with the natives. In 1614 a fort was built by the Dutch at the southwest extremity of the island, and another, called fort Aurania, Orange, where Albany now stands, which was settled before the city of New Amsterdam (New York); the latter was most probably not permanently occupied until the year 1619. From this period it remained in possession of the Dutch until the conquest of the colony by the English in 1664. A few years after, it was granted by Charles II. to his brother James, Duke of York and Albany, and the two principal, indeed the only cities at that time in the colony, were called after his title.

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[*] There are a large number of small establishments, employed in custom work, not included in the above estimate.

[†] John Pintard, L.L.D.

The earliest authentic record extant of the population of this city, is of the date of 1656, when several new streets were laid out, and a plan of the town sent to the city of Amsterdam, for the examination and approval of the directors of the West India Trading Company. At that time the village by the name of New Amsterdam contained only one hundred and twenty houses, of the humblest description, and one thousand inhabitants, including the garrison. Several rough engravings of the city, illustrative of its appearance at about this time, and for one hundred years after, are preserved among the records of the New York Historical Society. In 1686 the first charter was granted, which was renewed in 1730 with new privileges.

Population at different periods.

1696	4,302	1800	60,489
1731	6,628	1810	96,373
1756	10,381	1820	123,706
1773	21,876	1825	167,059
1786	23,614	1830	203,007
1790	33,131	1832	213,500

Averaging somewhat more than a tenth part of the entire population of the state.

The most compact part of the city is at its southern extremity, whence it extends on the north side along the course of the Hudson river, about two and three-quarters of a mile, and along the East river, from the southwest angle of the battery, three miles; its circuit about eight and a-half miles. The ancient irregularity of the city has been materially corrected by recent improvements; the upper or northern parts have been laid out with systematic regularity. Many of the streets are spacious, running in right lines, and intersected by others at right angles; in short, the whole of the upper portion of the city is laid out in this manner, and though the spirit of improvement has been active, and at a tremendous expense here, to reduce the site of New York to an entire level, there is a gentle ascent from Hudson and East rivers, and a commanding view of the city is afforded. The most distinguished streets are Broadway, commencing at the Battery, and running north by east nearly three miles, Greenwich street, Wall street, Pearl street, South street, Canal street, Grand street, the Bowery, East Broadway, &c. &c. Beside the Battery, a delightful promenade at the lowest or southern portion of the city, there are several open squares which serve the important purposes of ventilation and health, as the Park, Hudson square, Washington square, Hamilton square, Lafayette Place, Union Place, Clinton square. The approach towards the city on the north, has also been made more advantageous by several new roads, denominated *avenues*, agreeably to a plan of the late Gouverneur Morris and De Witt Clinton.

The materials of which the earlier buildings of the city were constructed were wood, and bricks imported from Holland. The style of architecture was steep roofs, tiled gables to the streets and alleys between the houses. Of this latter construction not an edifice now remains; the last of this character, situate in Broad street, and bearing date, according to the Dutch fashion, 1698, having been torn down for modern architecture in the spring of 1831. The wooden edifices are comparatively few in number, and are chiefly located in the suburbs. The modern taste in building is almost exclusively confined to brick, though a few houses in different places are constructed either of granite, free-stone, or of marble, obtained within the neighbourhood. The principal streets and public buildings and stores are lighted by gas, under the management of the Gas Light Company, which went into operation in 1825.

Bay and Harbour.—The bay and harbour of New York may be classed among the most convenient and beautiful in the world; the banks are bold and the bay interspered with many handsome islands; the city and surrounding land, when viewed on the bay in approaching the city, presents a scene truly charming and picturesque, and excites general admiration. The bay may be estimated at nine miles long and five broad, without including the branches of the rivers each side of the city. From the ocean, Sandy hook, to the city at the head of the bay, is about twenty miles. The water is of sufficient depth to float the largest vessels, and ships of ninety guns have anchored opposite the city. It has been repeatedly observed that the cold of winter has less effect upon the waters of New York harbour, than in several places farther south. The usual tides are about six feet, and this, with the greater rapidity of the currents, may be looked upon as the prominent cause why so rarely inconvenience is experienced from the formation of ice. During the severe winter of 1780–1, the harbour, however, was covered by a bridge of compact ice; and again, in the memorable winter of of 1820-1, the harbour and the branches of the two rivers were obstructed by the same cause for many days.

According to the reports made by the ward assessors of the amount of real and personal estate of the city of New York, it has been stated in 1828, as *personal*, thirty-six millions eight hundred and seventy-nine thousand six hundred and fifty-three dollars; as *real*, seventy-seven millions of dollars.

In 1829 as personal and real, somewhat less: but these estimates must be deemed as entirely too low. The whole of the bank capital in the city of New York is upwards of eighteen millions of dollars. The aggregate capital of the marine fire insurance and other incorporated companies, may be put down at thirteen millions of dollars. According to a late statement made by Alderman Stevens to the corporation, when on the discussion of the report in favour of introducing pure and wholesome water into the city of New York, the number of dwelling houses, stores, manufactories and churches was valued at seventy-five millions of dollars; the merchandise in the city at fifty millions; hence, the total value of buildings and merchandise is one hundred and twenty-five millions of dollars. But this estimate may be safely doubled.

Commerce.—The city of New York is justly considered the commercial emporium of the United States, and the revenue which it pays to the general government exceeds that of all the other states of the union.

The following table of exports, and customs, during the respective years, will show the increase of commerce since the year 1814, at which period the country was involved in war with Great Britain.

Year	Exports		Total Amt. of Exports	Custom Duties
	Domestic	Foreign		
1815	4,189,951	746,558	4,936,509	14,554,645
1816	10,475,985	8,470,613	13,946,598	10,785,354
1817	12,639,197	4,384,817	17,024,014	6,329,123
1818	11,873,934	5,720,237	17,594,171	8,259,011
1819	6,542,742	4,318,923	10,861,665	6,480,638
1820	7,034,322	4,735,199	11,769,511	5,487,374
1821	8,102,512	4,022,123	12,124,645	7,243,542
1822	9,228,631	6,177,063	15,405,694	9,941,702
1823	11,526,632	9,563,064	21,089,696	9,022,435
1824	11,657,312	10,652,090	22,309,362	11,178,139
1825	19,257,749	14,774,530	34,032,279	15,752,100
1826	10,743,846	8,693,383	19,437,229	11,525,862

A more satisfactory view of the commercial character of the city of New York, may be obtained from the official records of the custom-house of that district.

Exports from the District of New York in 1830 *and* 1831.

1830, 1st quarter	Domestic, in American vessels	2,234,992	
	do. in Foreign	366,375	
	Foreign in do.	144,212	
	do. in American	848,215	= 3,593,794
2d quarter	Domestic, in American vessels	3,427,645	
	do. in Foreign	315,973	
	Foreign in do.	265,147	
	do. in American	1,612,234	= 5,620,999
3d quarter	Domestic, in American vessels	2,283,474	
	do. in Foreign	360,421	
	Foreign in do.	273,499	
	do. in American	1,198,731	= 4,116,325
4th quarter	Domestic, in American vessels	2,600,352	
	do. in Foreign	269;631	
	Foreign in do.	184,504	
	do. in American	1,329,156	= 4,383,643
	Total exports in 1830		$17,714,561
1831, 1st quarter	Domestic, in American vessels	3,038,395	
	do. in Foreign	308,963	
	Foreign in do.	170,305	
	do. in American	1,282,528	= 4,800,191
2d quarter	Domestic, in American vessels	3,239,656	
	do. in Foreign	695,258	
	Foreign in do.	336,252	
	do. in American	2,658,830	= 6,949,996
3d quarter	Domestic, in American vessels	3,109,947	
	do. in Foreign	491,547	
	Foreign in do.	459,010	
	do. in American	3,385,423	= 7,445,927
	Total for three quarters of 1831		$19,196,114

The total invoice value of imports, including dutiable charges, in 1830, was

	American.	Foreign.
1st quarter	6,900,229	339,900
2d	8,716,599	417,672
3d	12,090,705	719,826
4th	10,608,623	266,166

The total amount of duties rising from imports at the port of New York, the first three quarters of the year 1831, amounted to about $15,500,000, an excess over the year 1830 of three millions of dollars. The total amount of duties for 1831 may be stated at rising twenty millions.

AMOUNT OF SPECIE EXPORTED FROM NEW-YORK.

From 1*st October*, 1830, *to September* 30*th*, 1831.

Fourth Quarter, 1830 October, November, and December.	Gold & Silver Coin, Am.	267,785	
	Gold Specie, Foreign	38,360	
	Silver do. do.	81,331	
			387,476
First Quarter, 1831 January, February, and March.	Gold & Silver Coin, Am.	14,000	
	Gold Specie, Foreign	43,416	
	Silver do. do.	183,344	
			240,760
Second Quarter, 1831 April, May, and September.	Gold & Silver Coin, Am.	96,262	
	Gold Specie, Foreign	58,825	
	Silver do do.	1,275,366	
			1,430,453
Third Quarter, 1831 July, August, and September.	Gold & Silver Coin, Am.	686,108	
	Gold Specie, Foreign	170,871	
	Silver do. do.	2,392,697	
			3,249,676
	Total exported,		$5,308,365

Since the completion of the Erie canal the commerce of the city has been greatly augmented by the numerous canal boats which ply between Buffaloe and Albany, bringing ultimately to the commercial emporium, the rich products of the great western country and the lakes, and sending in return the fine manufactures and luxuries of Europe. Numerous steam-boats, about nine months in the year, navigate the Hudson and East rivers, several of them superior in speed and architectural beauty to those on any other waters.

Banks.—There are sixteen city banks in New York, besides a branch of the United States bank. Some of these edifices are neat and commodious, of architectural beauty and proportion, particularly the Branch bank, the bank of New York, the City bank, and the Phœnix bank. Besides these banks, for the purposes of discount and deposit and other mercantile transactions, there is a *bank for Savings*, incorporated in 1819, and a *Seamen's bank* for a like purpose, incorporated in 1829. According to the report of the trustees of the former of these institutions for the year 1830, the number of depositors from the 1st of January to the 31st of December 1830, was fourteen thousand two hundred, and the total amount of deposits for that period was seven hundred and forty-one thousand five hundred and eighty-three dollars ninety-five cents. The results which have arisen from the bank of Savings, have been invaluably advantageous, and when it is considered that the total receipts of this corporation, from its commencement in 1819 to the date last stated, December 1830, have been more than six millions of dollars, the founders of this institution, among whom John Pintard, LL.D. deserves a particular notice, cannot but feel the highest satisfaction. The *Seaman's bank* for savings is also in successful operation for the benefit of that meritorious class of men.

In an enumeration of the moneyed institutions of the city, the *Custom-house*, which renders the greater portion of the entire revenue of the United States, deserves to be mentioned. It is situate in Wall street, at the head of Broad street. It is sufficiently to be lamented that an appropriate edifice has not yet been erected by the government of the union.

Manufactures.—The free and open access of the port of New York to the commerce of the whole world, has been attended with a necessary disadvantage to the amount of her manufactories. Nevertheless there is a number of extensive establishments for manufacturing purposes, and in a thriving condition. Among these are several iron founderies, a steel manufactory, type and stereotype founderies, sugar works, refineries and distilleries, hat, shoe and boot manufactories, whip manufactories, glass houses, breweries, printing-ink manufactories, carding machines, very extensive manufactories of saddlery, cabinet furniture, piano-forte and musical instrument manufactories, coach makers' establishments, manufactories for tobacco, &c. &c. Copper plate engraving, wood engraving, and the printing of books, are also on an extensive scale: and the first work on stereotype plates, from an American press, issued from New York. The stereotype establishments of Chandler, Bruce and others are on an enlarged scale. The New York chemical manufactory is an extensive institution, and annually sends out a large supply of sulphuric, nitric and muriatic acids, alum, borax, and other chemicals. Many of the mineral articles of the materia medica are also made here on a large scale. The shot tower of Youle, on the banks of the East river, near Kip's bay, deserves special mention as well as the card manufactory of the ingenious Whittemore, and the steam engine manufactories and founderies of Allaire, M'Queen, Youle and Bliss. The West Point foundery company, also carry on an extensive manufactory for steam engines and rail road carriages. The manufacture of leather is very extensively prosecuted by persons resident in the city: the tanneries are situated in various parts of the state—and principally in Greene and Delaware counties, where bark is abundant, and water privileges abound.

The number of hats furnished in the city of New York is estimated at not less than one and a half millions of dollars, at three dollars per hat. The American Institute, incorporated by the legislature of New York in 1828, for the promotion of manufacturing interests, and who held their annual fair in the city in October, at their anniversary in 1830 awarded premiums on the following among other articles manufactured in the city. Cotton goods, printed silk handkerchiefs, sewing silk made of American silk, hardware, locks, files, and cutlery, mathematical instruments, brass nails, cast-iron stoves, silver and plated wares, clocks, cut glass, chemicals, japanned leather, upholstery, &c. As long ago as in 1820, the returns made to Congress with the census, of the capital invested in manufactories in the city, amounted to nearly two millions, of which three hundred thousand dollars were invested in the manufacture of steam-engines and castings of every description.

The Dry Dock railways, an important method of repairing ships, and vessels of other descriptions, is now practised with great advantage by a company vested with banking privileges. The *Screw Dock*, an invention of singular importance and great simplicity for raising vessels with ease and rapidity out of the water, for repairs, is also in use at New York. Ample notice deserves to be taken of the extensive and elevated rank to which *ship-building* and *steam-boats* has attained at this port. Vessels in the service of almost every nation are built by her ingenious shipwrights.

Public Buildings.—New York is distinguished more by the excellence than by the number of her public buildings. Her churches collectively are entitled to considerable commendation.

The City Hall.—This conspicuous edifice, superior in splendour and extent to any other in the United States, excepting the capitol in Washington, is situate in that noble public walk the park. Its foundation was laid in May 1803 and the entire structure completed in May 1812, at the cost of five hundred and fifty thousand dollars. The building is two hundred and sixteen feet in front, by one hundred and five on the east and west fronts, and is adorned with two orders of architecture, the Ionic and Corinthian, raised on a rustic basement of nine feet in height, crowned with a balustrade, and the roof covered with copper. The centre part of the south front is finished with an attic story. On the blocking course above the attic cornice it is intended to place the arms of the city, agreeably to a design and model of the architect. The cupola is surmounted by the figure of justice. The basement story is rusticated and partly sunk; it is raised nine feet above the surface of the Park, and contains accommodations for the city watch, house-keeper, and a number of different offices. In front a terrace walk is raised three steps above the Park, from which you ascend by eleven steps to the colonnade of eight Ionic columns in front, covered with an entablature, and finished with a balustrade which forms a spacious balcony in front. You then enter into the vestibule; a corridore running longitudinally communicates with the mayor's offices, two private stairs, and with various offices in which the city business is transacted. Opposite the vestibule is a large circular marble staircase of thirty-one steps, leading to the second floor; on the wall surrounding these stairs on the second floor stands a circular range of marble columns of the Corinthian order, the entablature of which supports the dome and sky-light. Very recently a clock has been fitted up in the cupola, which is lighted at night with gas. A circular corridore communicating with one running lengthwise of the building leads to the room for the governor of the state, the common council chambers, three court rooms, and with several offices and jury rooms. The whole plan is so arranged as to be easy of access. The south, east, and west elevations are composed of handsome white marble, brought from the quarries in Berkeshire county, Massachusetts. The north part is built with brown stone, from a parsimonious fear the building committee entertained that the white stone might be too expensive. The architect was John M'Comb, Esq., but it may be added that the sculpture and carved work were executed by and under the direction of Mr. John Lemaire. The governor's room and the room of the city council are enriched with many superior paintings, of the several governors of the state, the mayors of the city, and other public characters, executed by the pencil of Trumbull, Vanderlyne, Jarvis, &c.

The Merchant's Exchange was commenced on the 1st of April 1825, and opened for business in May 1827. It stands on Wall street, and runs through to Garden street, a distance of about 150 feet. The principal front, which is on Wall street, is 115 feet wide, and that on Garden street, 114 feet. The general divisions of the plan are a building of parallellogramic form on both streets, connected by one of similar form, with circular ends, which form the exchange room, and which is thus rendered accessible from both streets. Since the erection of the building, however, a street has been opened on the lower side, which, not having been foreseen at the time of designing the plan, the architect was unable to avail himself of, to present a more finished appearance on that side than at present. The front on Wall street is built entirely of white marble from the quarries in West Chester, and is three stories high, exclusive of a basement, which is half out of ground. The front has been designed in the Ionic order, from the temple of Minerva Polias, at Priene, and an elliptical recessed portico has been introduced with great advantage, both as regards effect and convenience. A screen of four large columns and two antæ on the corners of the wings extends across the front of the recess in a line with the front of the building. These columns are thirty feet in height and three feet four inches in diameter at the base, and the stay of each is composed of a single block of marble. The columns support an entablature which runs across the whole front, on which rests an attic story, making a height of about sixty feet from the ground. The entrance on Wall street is by a flight of broad marble steps flanked on each end by a pedestal. From the portico three doors open into the vestibule, and one on each hand into insurance offices. The vestibule is nearly square, and is finished in the chaste and elegant style of the little Ionic temple on the banks of the Illysus in Athens. From the vestibule an elliptical staircase rises on the right hand, to lead to the different stories of the front building. Advancing through the vestibule you enter the grand saloon or exchange room, which is a magnificent apartment eighty-five feet long, fifty-five wide, and forty-five feet high, finished in the Ionic order after the temple of Minerva Polias at Athens. The spacious and lofty apartment has two parallel sides with semicircular ends, at the intersections of which are antæ and columns supporting a full entablature, with an arch resting on the columns at each end. The arches support a screen which forms a separation between the arched ceiling of the centre and the Ionic ceilings of the alcoves, and divides the whole into three compartments, producing a pleasing variety. The whole of the ceiling is divided into pannels; those of the centre being of an oblong rectangle, and those of the ends radiating from a centre. Passing through the exchange we enter an apartment, or rather vestibule, appropriated for sales by auction of ships and real estate, &c. On both sides of this vestibule are rooms occupied as offices, and a stairway leads to the basement below and to the second story. Here is a spacious room appropriated to the Board of Brokers, and to the Chamber of Commerce. On the right of this vestibule is the spacious reading room, which is furnished with the periodicals and daily journals, foreign and domestic, for the use of strangers and citizens. From the third story we ascend to the observatory on the upper section of the cupalo. The cupalo is 24 feet in diameter. The basement has superior accommodations for the post-office establishment, and offices occupied by brokers, newspapers, &c. For the plan and execution of this admirable building the city is indebted to Martin E. Thompson, architect.

Masonic Hall.—This recently erected building is situate in Broadway, and nearly opposite the city hospital. It is fifty-seven feet front, ninety feet in depth, and three stories high. The front is faced with granite, and the interior, which is divided into several convenient apartments, possesses on the second floor one spacious hall the full size of the edifice, and finished after the rich, florid style of Henry VII.'s chapel. It is the largest hall in the city. Architect, Hugh Reinagle.

Clinton Hall.—This edifice also deserves notice on account of its size, great convenience, and the important objects to which it is appropriated. It was built in 1829. It is located in Beekman street, near the Park. It is 50 feet broad by 100 feet deep, and three stories high, independent of the basement. Clinton Hotel, erected in conjunction with it, presents Clinton Hall as a building nearly 100 feet square. The basement is let for stores. The second story contains a spacious lecture room and accommodations for the mercantile library and a reading room. The third story is appropriated to the occasional use of different public bodies. The fourth story is occupied by the national academy of design and exhibition gallery of painting, under the direction of Mr. Dunlap, painter.

Churches and Places of Public Worship.—By an enumeration recently made, it appear that there are in New York 123 places for public worship, many of which are very neat and commodious, and several of them present edifices that are favourable specimens of architectural taste and beauty. The following is believed to be an accurate account of the various denominations of professing christians, with the number of places of worship belonging to each.

Denominations.	No. of churches or places of worship.
Episcopalian	22
Presbyterian	22
Presbyterian, not connected with the General Assembly	3
Reformed Dutch	14
Do. not connected with Synod	1
Society of Friends	4
Baptists	13
Methodist Episcopal church	12
Protestant and Reformed Methodist	6
Roman Catholics	4
Lutherans	2
Jews' Synagogues	3
Independents	4
Universalist	2
Unitarian	2
German Reformed	1
United Brethren	1
Mariner's church	1
New Jerusalem chapel	1
City Mission church of the Holy Evangelists	1
Of no regular denomination	4

American Bible Society.—This institution was founded in May 1816, and has most assiduously directed its energies to the objects of its formation. It has a board of thirty-six managers, all laymen, from several religious denominations. The society has upwards of six hundred auxiliaries scattered through every state and territory in the union. The number of Bibles and Testaments issued from its formation to the anniversary in May 1830, was 1,084,980. In May 1829, the society resolved, in case means were furnished in season, to supply every destitute family in the United States with a copy of the Bible within two years. According to a report made to the society in 1831, there had been 242,267 Bibles and Testaments used during the past year, making an aggregate since the formation of the society of 1,327,247.

American Tract Society.—Next in importance, the Tract Society is to be recorded. It is a recent foundation most liberally sustained. It is estimated that the average issue of tracts is about one hundred thousand, or one million of pages weekly. It has numerous auxiliary societies. The whole number of the society's distinct publications is five hundred and sixty-eight, many of them volumes of considerable size. The number of tracts published by this association during the year 1830–1, on the subject of temperance, was five hundred and sixteen thousand.

As connected with moral and religious instruction, many other institutions for the benefit of the rising generation flourish in this city. The names only of a part can be here enumerated. The American Sunday School Union; the New York Sunday School Union; the Bible and Common Prayer Book Society; the New York Protestant Episcopal Tract Society; the Colonization Society of the city of New York; the American Home Missionary Society; the General Protestant Episcopal Sunday School

Union Society; the New York Protestant Episcopal Press; the New York Protestant Episcopal Missionary Society; the New York, Manumission Society, and several Temperance Societies.

The *Book-Concern of the Methodist Episcopal Church* is located in the city of New-York with a branch at Cincinnati, Ohio. The business is conducted in a commodious building lately erected in Mulberry street, on a plan designed for extensive additions hereafter, which, when completed, will probably be the largest publishing establishment in the United States, as it now is in the city of its location. There are at present (1832), thirty presses in full operation, one of which being a power-press is equal to five common presses; and constant employment is furnished to above two hundred persons in the various departments of printing, binding, folding, &c.

In connection with this book-concern, is transacted the business of the Bible, Tract and Sunday School Union Societies of the Methodist Episcopal Church, auxiliaries and branches of which are numerous throughout the United States and territories, and all supplied with books from this source, or from the branch at Cincinnati. From this press is issued weekly " the Christian Advocate and Journal, and Zion's Herald," a religious paper, having upwards of twenty-seven thousand subscribers.

Of the numerous works here issued, a large proportion are stereotyped, and the profits of the establishment, after defraying the expenses of its management, are wholly devoted to religious and charitable uses.

Literary Institutions.—The literary institutions of New York are numerous, but for the most part in their infancy. By far the most venerable and important is Columbia College, founded by charter in 1754, under the name of King's College, partly by the munificence of the corporation of Trinity Church, and partly by the British Society for the Promotion of the Gospel in Foreign Parts. During the interval which elapsed between the years 1776 and 1784, the business of instruction was necessarily suspended in consequence of the trials of the revolutionary contest, and the college edifice appropriated to the purpose of a military hospital. Upon the restoration of public tranquillity certain individuals were appointed by an act of the legislature, dated May 1, 1784, to superintend the general interests of education throughout the state, under the title of Regents of the University, whose number was subsequently increased by an act passed 26th November in the same year. By this body the duties of trustees of the college were also discharged, until the year 1787. On the 13th of April 1787, an act was passed by which the original charter of the college was confirmed, the name of the institution altered to Columbia College, and its direction confided to certain persons mentioned in said act, who were authorized by the provisions of the same to discharge the duties of trustees of the college, and were empowered, for the time to come, to fill all vacancies which might occur in this number by death, resignation or otherwise, after it should be diminished to twenty-four. The government of the college has continued to be exercised in conformity with this act since that time.

Columbia college is liberally endowed, possessing property to the amount of nearly half a million of dollars. It was formerly composed of a Faculty of Arts and a Faculty of Physic. The latter was abolished in 1813. The Faculty of Arts consists at present of a professorship of Moral and Intellectual Philosophy, Rhetoric, Belles Letters and Political Economy; a professorship of Greek and Latin Languages, a Jay professorship of the same, a professorship of Natural and Experimental Philosophy and Chemistry, a professorship of Mathematics, Analytical Mechanics, and Physical Astronomy. Certain branches of instruction and the general superintendance of the college are committed to the charge of the president of the college, who is chosen by the trustees. The number of students is generally about one hundred and thirty. There are two literary societies connected with the college, composed of under graduates, the Philolexian and Peitholopian societies, and a grammar school recently organized, containing one hundred and ninety students, subject to the government of the trustees of the college.

The number of graduates of Columbia college since its foundation is about eleven hundred; many of whom have been eminent in the service of the church and state.

Columbia college possesses an excellent library of about four thousand five hundred volumes, and enjoys an admirable location in a commanding part of the city: it is one of the finest specimens of architecture in New York.

University of the City of New York.—This is the name of a college recently projected by a number of gentlemen of New York, and designed to embrace a more extensive system of literature and science than any heretofore established. A literary convention was held in the city in October 1829, with a view to its formation; subscriptions to a considerable amount have been already obtained among the citizens for this object; a board of council has been chosen, by whom the Rev. James Matthews, D.D. has been chosen chancellor of the institution. A distinctive character of this establishment is an entire exclusion of all sectarian influence. A scite for the contemplated building has been chosen, and the whole is in a train of successful progress.

The several faculties are divided into a Faculty of Letters, a Faculty of Science and the Arts, a Faculty of Law and a Faculty of Medicine.

The General Theological Seminary of the Protestant Episcopal Church of the United States.—This institution is situated about two miles from the City Hall, on the eastern bank of Hudson river. The block of land on which the seminary is located is an oblong square of eight hundred by one hundred and eighty feet; the present value of which is sixty thousand dollars, and was presented to the seminary by Clement Moore, son of the late Right Rev. Benjamin Moore, D.D.

The present building is one wing of those contemplated, whenever the funds of the institution will enable the trustees to complete the design, and is a spacious stone edifice of Gothic architecture, one hundred and ten feet in length, sixty feet wide and three stories high. At this seminary (instituted in 1819, partly by the funds of the Episcopal church and partly by a liberal bequest of the late Jacob Sherrard of this city), about one hundred and forty candidates have been prepared for the ministry. The late Mr. John Kohn of Philadelphia has recently bequeathed to this institution one hundred thousand dollars, on the demise of his widow; at present it relies for support in a great measure on the liberality of the friends of the church. The faculty consists of a Professor of Biblical Learning and the Interpretation of the Scriptures, a Professorship of Systematic Divinity, of Oriental and Greek Literature, and also a Professorship of the Nature, Ministry and Polity of the church.

Mercantile Library Association —This institution was organized in 1821, and occupies appropriate apartments in that substantial and superior edifice denominated *Clinton Hall.* An elegant lecture room is provided, in which lectures are delivered on several branches of the physical and ethical sciences. The present number of subscribers is thirteen hundred; the library consists of about six thousand volumes. The annual income derived from various sources, is about two thousand five hundred dollars. Active zeal and rigorous enterprise characterize this institution, and no small share of its present flattering condition is owing to the liberality of Philip Hone, late mayor of New York.

General Society of Mechanics and Tradesmen.— This society was incorporated in 1792, and was originally designed for the purpose of affording aid to the widows and children of deceased members, which it has effectively done, to a large amount annually. Meeting with flattering support, it established a school for the education of the children of deceased members whose circumstances required their assistance, and subsequently the school was enlarged, so as to accommodate many of the children, both male and female, of the more wealthy members, whose attention was attracted to the school by the high character it maintains, and which it yet fully sustains; by this arrangement the tuition fees of those who pay, defray the whole expenses of the establishment. The children are all alike educated, and the distinction, always odious, between those who do and those who do not pay, is unknown in this valuable school. Some years ago the society enlarged the sphere of its usefulness, by the estsblishment of a library, for the exclusive and gratuitous use of the apprentices of mechanics. The library is open every evening (excepting on Sundays), and contains about eleven thousand volumes: the number of readers now amount to fifteen thousand. A more spacious building has recently been purchased, which will enable the society to enlarge the school and library, and add thereto reading rooms, for the apprentices of mechanics. The society is conspicuous among the many valuable institutions of New York, and has exercised a large and salutary influence on those for whose immediate benefit it was specially designed. The amount of its property is estimated at seventy-five thousand dollars, and its annual revenue at four thousand five hundred dollars.

MEDICAL.—The nature of the medical profession is such, that its cultivation as a science becomes a duty of vital importance to society; and whenever individuals are congregated to any considerable amount, measures, the offspring of individual efforts or of municipal authority, are adopted to aid in the advancement of the healing art. A careful examination into the lives and services of those who exercised the abilities of the medical profession in this city even at an early date, will show that New York has at all times been favoured with some few in this profession, whose career was a blessing to the state. Long before the establishment of any thing like a medical school, some pupil of Boerhaave, or a well educated physician of a foreign university, might be found among us; and Dubois, Dupy, Magrath and Farquhar are often mentioned as conspicuous in their day and generation. As quackery, however, is always found to prevail, wherever there are knaves and fools to dupe and to be duped, the historian of New York, Smith, has given an early evidence of this species of dishonourable livelihood. As far back as 1753, speaking of this city, he observes, "Quacks abound like locusts in Egypt, and too many have recommended themselves to a full and profitable subsistence;" and notwithstanding numerous and salutary, as many of the statutory regulations of this state since that period have been, it cannot be denied that there is much room for further legislation, to place the profession of the healing art on a sure and honourable foundation, and to guard against the pernicious encroachments which are still found to prevail on this subject in this metropolis. The establishment of schools of medical learning, on a broad and liberal principle, the avoidance of monopoly in the system of instruction, and the generous cultivation of the profession, as the first of the liberal sciences, are the only means which a wise legislature will countenance and support in order to secure to the medical character its proper dignity.

The first essay in the United States for the purpose of imparting anatomical knowledge by means of dissection, was made in this city in 1750, by Drs. John Bard and Peter Middleton. The first attempt towards the promotion of a medical school was made in 1768, during the administration of Sir Henry Moore and Lieutenant Governor Colden; and in the following year it was organized, under the direction of King's College, and Jones, Middleton, Smith, Clossy, Tennent and Bard appointed its respective professors. Eminent as several of these individuals were, the prospects of this school were early destroyed by the revolutionary war. In 1783 the regents endeavoured to re-establish this organization; but this attempt proved abortive. In 1792 the trustees of Columbia College created another medical faculty in their institution, and appointed distinguished individuals to lecture on the several branches of medical and chirurgical knowledge.

This organization lasted until 1813, when it was dissolved by an act of the trustees.

College of Physicians and Surgeons of the University of the State of New York.—In conformity to an act of the legislature passed as early as 1791, the regents of the university exercised the power of establishing this institution, which was chartered on the 12th of March 1807. In November following, the business of instruction commenced under the most flattering indications of success. In 1810, the rapid progress of the college in its importance and usefulness received a temporary check, owing to certain difficulties having taken place between the existing president, Dr. Thomayne and the professors, which induced the regents to reorganize the institution in 1811, under the venerable Dr. Bard, as president, to create other professors, and modify the internal government of the school. On the 15th of May, the first medical commencement was held, and the degree of doctor of medicine conferred on eight candidates, a greater number than had at any one time previously received that honour in New York. In September 1813, the consolidation of the two medical schools of New York took place; i. e. the union of the late Medical Faculty of Columbia College with the College of Physicians and Surgeons. From this period till 1825, this establishment proceeded successfully with an annual increase in the number of its students and its career of utility and reputation. For several years it enumerated above two hundred students, from different and distant parts of the union, in attendance at its winter session of lectures. An anomalous and ill devised form of government, however, the clashing interests of the trustees and professors, and charges of serious import urged against the teachers, induced the regents to examine into the grounds of accusation; an elaborate report was published by the regents, who declared, after the minutest inquiry, the charges against the faculty groundless, and to have arisen from jealousy and professional rivalry. A motion was made by the honourable the regents to remove the whole board of trustees, but the assumption of vested rights caused them to abandon the wholesome measure. Some modifications in the government of the college, nevertheless, were carried into effect. Broils and contention, however, continued, when, in April 1826, the professors, wearied with unavailing attempts to silence this opposition, came to the conclusion that "it would best consist with their own self respect," to withdraw altogether from the institution, and accordingly they tendered the resignation of their professorships and offices. The board of regents accepted their resignations April 17th 1826, and presented them their thanks, "for the faithful and able manner in which they had filled their respective chairs as instructors and lecturers in said college."

On the seventh of July 1826, at a special meeting of the regents of the University, held at the Capitol in Albany, the vacancies caused by the resignation of the late professors, were filled up in the several departments, and John Watts, M.D. appointed president.

The number of students attending the school, since that period, has varied from one hundred and thirty to one hundred and fifty.

Rutger's Medical College.—This institution was created by the former professors of the college of physicians and surgeons, and a commodious and neat edifice erected for the purpose, at an entire cost of upwards of twenty thousand dollars, by the faculty, at their own expense. It is located in Duane street, near the New York Hospital. The lecture rooms are three in number, one for chemistry, a large hall for the practice of medicine, obstetrics and materia medica on the second floor; and the surgical and anatomical theatre on the third floor. The saloon of practical anatomy, on the fourth floor, is of superior construction, and convenient in its arrangement. The whole building is provided with gas lights, and warmed by a single fire, burned in the basement, from which heated air is conveyed by flues to all parts of the house. This institution was opened for instruction in November 1826, and honoured by the attendance of one hundred and fifty medical hearers. At four successive sessions of the college, the number of its students continued about the same, and the courses of instruction, with the means of illustration afforded by the chemical laboratory, the anatomical museum, and the cabinet of the professors, secured to its patrons their entire approbation. In consequence, however, of legislative enactments, the labours of the school are at present suspended.

New York Hospital.—This is one of the noblest and most admirable institutions of this city. The ground upon which it stands is bounded in front by Broadway, in the rear by Church street, Anthony Street on the north, and Duane street on the south. The building or buildings occupy an area of about 450 feet in length, and 440 in breadth. Part of this area in front, is at present owned and occupied by individuals, leaving an avenue of about 90 feet, leading from Broadway, which is planted with a double row of lofty trees. The site of the hospital is elevated, and about six hundred yards from the Hudson river. The principal edifice denominated the hospital, is of grey stone. It extends 136 feet in front, 52 feet in height, 50 feet deep in the centre, and 86 feet deep in the wings, which projects on each side. It was originally only two stories high; it is now three above the basement. Its wards accommodate three hundred patients; besides which there are a theatre for surgical operations, and other apartments for the convenience of the superintendant, apothecary, library, &c.

The charter for this institution was granted by lord Dunmore, then governor of the province, in 1771, at the instance of Peter Middleton, John Jones, and Samuel Bard, three eminent physicians of this city. Dr. Bard, in particular, may be considered its projector. In 1775, the hospital was burnt down by accident. In 1791, it was reopened for the sick and disabled, and afterwards extended to infirm and friendless seamen. The money arising from private subscriptions having proved inadequate, the legislature was induced at various periods to confer grants upon it of the public money. These were increased from time to time, until March 1806, when an act was passed, authorizing 12,500 dollars per annum to be paid to the institution out of the duties on public executions, till the year 1857. The funds of the institution are also augmented by a tax on seamen's wages, and the members the corporation pay on their admission forty dollars each.

The government of the hospital is under a Board, consisting of a president, a vice-president, a treasurer, secretary, and twenty-five other members. The Board appoint a visiting committee, and elect the physicians and surgeons annually. Of these there are four physicians and four surgeons. There is also a house physician, house surgeon, apothecary, &c. There is a large and excellent medical library connected with this institution, embracing nearly four thousand volumes on medicine, surgery, and the auxiliary branches of science; besides a well chosen botanical library, purchased by the Board from Dr. Daniel Hosack.

Asylum for the Insane.—This institution is at Manhattenville, about seven miles from the city; it was built by the government of the New York City Hospital, and is under their immediate care and control. As early as 1808, a building for the accommodation of lunatics was erected on the grounds of the city hospital, capable of accommodating sixty patients. But the inadequacy of this establishment being too clearly evident, the governors of the hospital applied for legislative aid, to enable them to erect the present asylum; and through the instrumentality of the late Thomas Eddy, De Witt Clinton, and others, the liberal appropriation of 10,000 dollars per annum for forty-four years was made in behalf of this benevolent undertaking. The Bloomingdale Asylum is admirably situated, and commands one of the most extensive and interesting views in the United States. The plan of the building is the design of Thomas C. Taylor, Esq. The front view is four hundred and fifteen feet by one hundred and eighty, which includes the wings; the whole is three stories high, exclusive of the basement story, and is intended to contain two hundred and fifty rooms. The central part is two hundred and eleven feet in front by sixty feet deep; it is built of brown hewn stone of excellent appearance, and of the most durable nature. It is not too much to say that this institution is the first of the kind in the United States, and that New York has worthily displayed her resources in the ample provision she has made for the afflicted inmates of the asylum.

Literary and Scientific Societies.—There are several associations in New York whose prominent object is the promotion of general and scientific knowlege. The following are the most important.

New York Historical Society.—This association originated from the example of the Massachusetts Historical Society. Its commencement was in 1804, and an act of incorporation was obtained in 1809. Its professed object is to collect and preserve whatever is best calculated to illustrate the natural, civil, political and ecclesiastical history of the United States and the state of New York in particular. That the society has not been unmindful of this high trust, its extensive and unique library of ten thousand volumes, embracing materials for the American historian, its cabinet of medals, maps, engravings and valuable MSS., abundantly evince. It has published several volumes of *Collections*, illustrative chiefly of facts and circumstances in American history. Its most efficient founder was John Pintard. This society has recently obtained an admirable location in Broadway.

Literary and Philosophical Society.—This association originated in 1814, and was incorporated by an act of the legislature the same year. It has published one volume of Transactions, quarto, which contains among other matters the inaugural discourse of its first president, De Witt Clinton, L.L.D. The second volume, part 1st, is enriched with the results of Capt. Sabine's late experiments.

Lyceum of Natural History.—This society was incorporated in 1718. It possesses a valuable cabinet of minerals, an herbazium of great extent, a rich cabinet of zoology, ichthyology, &c. &c. No institution in the state has so ably and so zealously devoted itself to the important object of its formation, and its printed transactions, in several volumes, are extensively known and commended. Its most distinguished patron was the late Samuel L. Mitchell, M.D. L.L.D., who long held the office of president.

Horticultural Society.—Incorporated in March 1822. This association has effectively directed its energies to the best means of improving the cultivation of our vegetable productions, and to the acclimation of exotics of an esculent nature. It has acquired a substantial reputation for the services it has rendered horticultural science. A periodical journal under its auspices is published in the city. The society, besides ordinary members, has honorary and corresponding members.

Academy of Arts.—This is the oldest institution of its kind in the United States. It was commenced in 1801. Among those who suggested the plan of the undertaking, and who have zealously patronized it, might be enumerated the names of several gentlemen of the first importance in the state. The property of this association consists of a large collection of fine paintings, among which are a portrait of their former president, Chancellor Livingston, and a full length portrait of Benjamin West, painted by Lawrence, a large collection of antiques, statutes, busts, bass-reliefs and a library of books on the fine arts. Besides these treasures, the society possesses a copy of the engravings and views of Piranesi, in twenty-four superb volumes, presented to the Academy by Napoleon Bonaparte. The accommodations of the institution are well calculated for the purposes of its exhibition, and are situate in Barclay street, near the Park. The members are divided into academicians and associates; the former must be artists by profession. The venerable historical painter, John Trumbull, Esq. is the present president.

National Academy of the Arts of Design.—The enterprise of a number of young gentlemen, artists and amateurs, gave origin to this association. It was organized in 1826, and opened its first exhibition in a private room in Broadway. They have recently been accommodated with suitable apartments in Clinton Hall. None but the productions of living artists are admitted for exhibition. The objects of the society, as announced by them, are the mutual improvement of its members, and the instruction of all others who wish to become students of the arts of design. To secure these intentions, lectures are delivered, and apparatus and models furnished to the pupil.

New York Society Library.—The beginning of this society may be dated back as far as 1729; it is the oldest and most valuable library in the state, and contains upwards of twenty thousand volumes on the various subjects of general literature, theology, history, law, medicine, political economy, &c. &c. The building which it occupies is situate in Nassau street, opposite the middle Reformed Dutch Church. It is supported by the annual subscription of its members.

The Athenæum.—This is a recent establishment, which was formed in 1824. Its objects are to sustain a library and reading room, to maintain lectures on various branches of general literature and science, &c.

Medical Society of the City and County of New York.—This is an institution created in conformity to a law of the legislature, passed in 1806, organizing medical societies throughout the different counties of the state.

Charities.—No city in the union, perhaps none of its size in the world, can claim a greater number of efficient charitable institutions than the city of New York. Her paupers, embracing a large body of emigrants from the shores of Europe, find the hand of Christian beneficence liberally opened to them, both in poverty and sickness. To notice at length these numerous institutions, would far exceed the limits assigned to this article. The following enumeration of the principal ones must suffice. The establishment, on a broad and liberal scale, founded and supported by the corporation of the city, denominated the Alms House and Fever Hospital at Bellevue, is delightfully situate on the bank of the East river. The New York Dispensary, incorporated in 1795. The Northern Dispensary, incorporated in 1830. The House of Refuge, which combines together the advantages of a prison, a manufactory and a school on the Lancasterian plan. Two Lying-in Hospitals. The Eye Infirmary. Several Orphan Asylums. The Humane Society, for the resuscitation of persons from suspended animation and for the aid of imprisoned debtors. The Society for Aged and Indigent Females. The Deaf and Dumb Institution, a noble establishment, incorporated in 1817. The Medical Mansion, built by the munificence of Jacob Lorrillard, Esq. though not strictly a charity, deserves also to be noticed. It is designed for the accommodation of invalids generally, and particularly for those who visit the city for the purpose of obtaining the benefit of the advice of the distinguished members of the medical profession, and who can here be accommodated (with or without their families) with suits of furnished rooms, in a spacious building, which is situated in a retired and pleasant part of the city, surrounded by fine pleasure grounds, and in full view of the Hudson river: the inconveniences ofttimes incident to the sick in boarding-houses, led to the establishment of the Medical Mansion, where invalids have the advice and attendance of any physician they may prefer, and are accommodated with apartments and attendance in accordance with their means or wishes. Besides these, there are many Assistance Societies of mechanics, tradesmen, poor widows, &c. &c.

School Fund and Common Schools.—The city of New York participates in the munificent fund of the state appropriated to the advancement of common education.* There were in 1829, eleven public schools; nineteen charity schools; three incorporated schools; and four hundred and thirty-six private schools, at which were educated twenty-two thousand nine hundred and forty-three pupils. Since that time the number has been greatly augmented. At the *Sunday* schools upwards of twelve thousand children are educated. Besides these, there are a number of *infant* schools, at which probably from two to three thousand children under the age of four years are instructed. At the Roman Catholic free schools about thirteen hundred children are educated.

Penitentiary System.--The penitentiary, formerly at Bellevue, is now removed to Blackwell's Island, on which are being erected edifices of great extent. The penitentiary system of New York embraces details far too extensive to allow of adequate notice in this place.

Municipal Government.—This is in the hands of a mayor and two separate councils, the one consisting of the aldermen, the other of the assistant aldermen of the fifteen wards into which the city is divided.

Courts.—In the city of New York, are holden the sittings of the United States circuit court, for the southern district of New York, in April and September. The United States District Court for the southern district of New York, on the first Tuesday of November. The May term of the New York Supreme Court; and at stated intervals, the sittings of the New York State Court for the county; the court of Chancery; the vice chancellor's court; the court of Oyer and Terminer; the New York Superior court; the court of Common Pleas; the court of Sessions the Marine court; the public court, and the several justices' courts.

Public Amusements.—There are four theatres in the city, the Park theatre, the American theatre, the Chatham theatre, and the Richmond Hill theatre. The two former large and magnificent buildings. At an early period, theatricals seem to have met with great encouragement in New York, but the reader is referred to the History of the American Stage, by William Dunlap, Esq. for minute details. There are two museums; the American Museum, founded by the late John Scudder, in 1809, and Peale's Museum, of a recent establishment. Several public gardens are places of great resort during the heats of summer. The introduction of the Italian opera in the city in 1825–6, under the direction of the Garcia troupe, constitutes one important era in the public recreations of New York; since which period a correct taste for music has rapidly spread.

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* See *Education* in our Article STATE OF NEW YORK, pp. 564 to 567.—ED.

Periodical Literature.—The following detail exhibits a laudable zeal in this species of literature. There are thirteen daily newspapers; ten semi-weekly; and twenty-four weekly papers. Of these one is in the French language, two in the Spanish, and one is in the Spanish, French, and Italian. It is estimated that ten millions of sheets are annually issued by the news presses.

Many periodical journals of a monthly character, devoted either to literature or science, or theology, have at different periods been published in New York. The following list embraces the more conspicuous of them. The New York Magazine. The New York Medical Repository. The United States Magazine and Review. The New York Medical and Physical Journal. The American Review; the American Medical and Philosophical Register. The Literary and Scientific Repository. The Churchman's Magazine. The New York Medical Journal. The New York Record, &c.

Mortality.—The city of New York may be classed among the most healthy of its size in the world. As no register of births, however, is preserved, one important item is wanting in estimating its comparative salubrity. Its apparent average mortality, greater than that of some of its sister cities, is to be referred to the number of emigrants who resort to this great emporium. The characteristic feature of a large proportion of the most prevalent disorders is inflammatory; hence, the immense outlet of human life by pulmonary consumption: and the number of still born cases is supposed to have much increased of late years by the injudicious use of the secale cornutum, or ergot. The deaths from the drinking of cold water in some summers of great solar heat, serves to enlarge the bills of mortality. This was particularly the case in the ardent season of 1825. The yellow fever has been less frequent in its recurrence than formerly. This by some is attributed to the improved state of our domestic policy, and by others to a more judicious system of quarantine regulations. The visitations of this disease have been, since 1795, in the years 1797, 1798, 1801, 1803, 1805, 1819 and 1822.

The average temperature of New York throughout the year is stated at 55° of Fahrenheit. In winter the thermometer is rarely lower than 15° or 20° below the freezing point; sometimes the mercury falls to zero, and it has been observed at two, three, four or six degrees below it. Most unquestionably the nearness of the Atlantic and the gulf stream, conduce to abate the severity of the winter. Snow is not of frequent occurrence, and rarely continues on the ground more than ten or twelve days at a time. The winter closes about the 10th or 15th of March. The temperature of the summer is rarely higher than 80° or 84°; there are a few days in which the thermometer ranges between 90° and 96°, but this heat is of short continuance, as the evening sea breezes cause a great abatement of it at night. There are not a few sudden changes in temperature, both in summer and in winter. The greatest change yet noticed in New York took place in August 1809, when by the sudden coming on of a northwest storm of rain, the thermometer evinced a difference of forty degrees within the course of fifty-six minutes. But this is no fair sample of the general character of the sudden vicissitudes of the weather. The prevailing winds in summer are from the south and south-west, in winter from the north, north-east and north-west.

The annual average of deaths is stated, by Villerme at Paris, as 1 to 32 $\frac{6}{20}$. In London it has been put down as 1 to 38 or 40. In Glasgow as 1 to 44. The annual mortality at Naples is reported as 1 to 28¼. In the whole United States it has been published as 1 to 40. In the healthiest districts of the U. S. as 1 to 56, and in the most unhealthy as 1 to 35. In New York it may be set down as 1 to 38½. Notwithstanding the speculations of many ingenious writers, as Williamson, Volney, Niest, &c. there is not much reason to suppose that our seasons have become much milder, or are in any particular manner ameliorated.

This assertion seems corroborated by the various accounts that have been published of the weather during the winter of 1831-2, in various parts of the United States. According to some, this winter has been colder than ever before within the memory of man. In Georgia and Tennessee the mercury was at zero: in Washington 5 or 6° below: and in Augusta, Maine, 26° below zero. The city of New York also furnished repeated examples of severe cold during the same season.

The number of deaths in New York as reported by the city inspector was as follows:

In	1826	1827	1828	1829	1830	1831
Deaths	4973	5181	5181	5094	5537	6363

Character.—The multitudinous population of this city presents an endless variety in manners and character. A liberality of feeling and unaffected hospitality have been the result. Active industry and enterprize (often bordering on rashness) are the prevailing characteristics of all classes. Amidst a strong devotion to wealth, it is gratifying to perceive that an attention to higher objects has not been overlooked. Her public school system, her Lancasterian, Sunday, and infant schools, her temperance societies, her innumerable charities, all promise a nett reward to their benevolent founders. The respective liberal professions may boast many members of the highest attainments, who tend to diffuse through the various classes of society a proper respect for literature, science and the elegant arts. This commercial emporium is not unworthy the name by which she is recognized, and may, above all, claim that whether the avenues to her trade have been closed by legislative restrictions, or during the uprofitable contest of arms, her fidelity to the union has never for a moment been questioned.

J. W. Francis.

YORK, southwestern county of Maine, bounded by Great Ossipee river, separating it from Oxford county of the same state on the N.; by Cumberland county of the same state N.E. and E.; by the Atlantic Ocean S.E.; by Piscataqua bay or the harbour of Portsmouth, separating it from Rockingham county of New Hampshire S.; by Salmon Fall or higher Piscataqua river, separating it from Stafford county of New Hampshire S.W. and W.; and by the northern part of Stafford county New Hampshire N.W. Greatest length from S. to N. 53 miles; greatest breadth 30, but mean breadth 15, and area 795 square miles.

The very rapid slope of this county is to the southeast very nearly. Falling from the nucleus of the White Mountains, the streams of Piscataqua, Moussum, Kennebunk, Saco, and some rivers of lesser note bear their foaming currents to meet the high and violent tides of the Atlantic. The surface is generally broken, but soil good. In 1830 it contained a population of 51,722, or $64\frac{2}{3}$ nearly to the square mile. In 1831 there were 36 post-offices in this county.

York, seaport and township, and also the principal seat of justice of this county. The town of York is situated at the mouth of the small river Berwick; N. Lat. 43° 10′, and Long. 6° 15′ E. from W. C. By the census of 1830, this township contained 3485 inhabitants.

YORK, one of the southern counties of Pennsylvania, bounded by Adams county W., Cumberland N.W., Susquehanna river, separating it from Dauphin N., and Lancaster N.E. and E.; by Hartford county in Maryland S.E., Baltimore county in Maryland S., and Frederick county in Maryland S.W. York county bounds on Maryland 42 miles, but the longest part is a line parallel to the general course of Susquehanna river 48 miles, mean width 18, and area 864 square miles. Extending in Lat. from 39° 42′ to 40° 43′ N., and in Long. from 0° 04′ W. to 0° 46′ E. from W. C.

The northern and central sections, comprising the much larger part of this county, declines to the northeastward, and is drained into the Susquehanna in that direction by Codorus, Conewago, and Yellow Breeches creeks. The extreme southeastern angle has an eastern declivity. The face of the county, though broken by hills and decorated by some minor mountain ridges, has much sameness of character. The soil is generally good, and much of it excellent; staples, grain, livestock, &c. Chief town, the borough of York. Population in 1820, 38,759, and in 1830, 42,859.

YORK, post-town, borough, and seat of justice, York county, Pennsylvanania, situated on Codorus creek, 22 miles a little S. of W. from the city of Lancaster, and by post-road 87 miles a little E. of N. from W. C., and 24 S.S.E. from Harrisburg. N. Lat. 39° 57′, and Long. 0° 17′ E. from the meridian of W. C. The site of York is a plain, in part liable to occasional submersion. The streets are extended at right angles to each other, and beside the ordinary county buildings the borough contains an alms-house, academy, several schools and places of public worship. The population in 1820 amounted to 3845, and in 1830 to 4216.

YORK, river of Virginia, formed by two main branches, Pamunky and Matapony rivers. Matapony river has the extreme source on the eastern border of Orange county, near the Rapid Ann, about twenty-five miles westward from Fredericksburg, but the most numerous of its constituent creeks are in Spottsylvania. These creeks unite within and traverse Carolina, and thence forming a boundary between King William and King and Queen, unites with the Pamunky to form York river, after a comparative southeastern course of 80 miles. The valley of the Mattapony lies between those of the Rappahannoc and Pamunky, is traversed by N. Lat. 38° and the meridian of W. C.

Pamunky, river of Virginia, and the principal constituent of York river. The Pamunky is formed by Pamunky proper and North Anna. The latter rises in Orange, the northern part of Louisa and in Spottsylvania counties, and flowing thence south-eastward, unites with the Pamunky, between Caroline and Hanover counties.

The Pamunky rises in the South West Mountain, on the border between Albemarle and Louisa; drains the southern and central part of Louisa, and traversing Hanover, joins the North Anna. Below their junction the united waters, known by the name of Pamunky, preserves the original course south-eastward about 45 miles comparative course, but perhaps double that distance by the bends to its junction with Mattapony to form York river. The entire comparative length of Pamunky by either branch is about 90 miles. The broadest part of the valley but little exceeds 30, and is only about 15 miles mean width, and area 1300 square miles, lying between those of James and Chickahominy on the right, and Mattapony on the left.

Below the union of its constituent streams, York river is rather a bay, varying from two to three miles in width, extending to the S.E. 27 miles, and thence E. 12 miles, into Chesapeake between York and Gloucester counties. Below the junction of Pamunky and Mattapony rivers, York bay does not receive a tributary above the size of a small creek. It admits ships of any size, to or near the Great Bend at York town, but shallows above, so as to admit only coasting vessels.

Including all its confluents, the valley of York river lies between those of James and Rappahannoc. The greatest length 130 miles, from the mouth of

York river, to the extreme source of North Anna river in South West Mountain, but, if taken with this extent, the mean width would not exceed 20 miles, and at the utmost breadth only about 45 miles, the area 2600 square miles. Extending in Lat. from 37° 15′ to 38° 16′, and in Long. from 0° 41′ E. to 1° 22′ W. from W. C.

YORK, county of Virginia, bounded by Elizabeth city county S.E., Warwick S., James city W. and N.W., York river separating it from Gloucester N., and Chesapeake E. Greatest length along York bay 34 miles; mean width 6, and area 204 square miles. Extending in Lat. from 37° 08′ to 37° 23′ N., and in Long. from 0° 12′ to 0° 46′ E. from W. C.

Narrow as is this comparatively lengthened county, it occupies nearly one half of the width of the peninsula between York and James rivers. Declivity northwards towards the latter. The soil is generally good. Chief town York town. Population in 1820, 14,384, in 1830, 5354.

YORK, district of South Carolina, bounded by Lancaster district E., Chester district S., on the W. by Broad river, separating it from Union and Spartanburgh districts; on the N. by Lincoln county North Carolina, and N.E. by Catauba river separating it from Mecklinburg county North Carolina. Length from E. to W. 35, breadth 23, and area about 800 square miles. Extending in Lat. from 34° 48′ to 35° 07′ N., and in Long. from 3° 55′ to 4° 40′ W. from W. C. This district, occupying the whole space between Catauba and Broad rivers, contains part of two inclined planes. The Broad river plane, or that on the westward, declines a little west of south, and is drained by Turkey, Bullock, Kings, and Buffalo creeks. The opposing or eastern plane declines southwestward, and discharges in that direction Fishing, Alison's, and Crowder's creeks. Surface hilly. Chief town Yorkville. Population in 1820, 14,936, in 1830, 17,790.

YOUGHIOGANY, river of Pennsylvania, Maryland and Virginia, having its most remote source in Preston county of the latter state, but deriving its most numerous southern tributaries from the valley between the Back-bone and Laurel mountains, Alleghany county, Maryland. From this elevated tract the main stream flows nearly due N. by comparative courses 35 miles, enters Pennsylvania between Fayette and Somerset counties, within which it flows about 8 miles direct course to where it is joined by Castleman's river, an equal or probably superior stream, entering from the N.E. Some of the southern fountains of Castleman's river rise in Alleghany county, Maryland, but the greater part of its tributaries flow from Somerset county Pennsylvania and rise in the same valley with the confluents of Youghiogany. Below the union of the two main branches the Youghiogany, assuming a north-western course, continues in that direction by comparative distance 60 miles, to its junction with the Monongahela at Mackee's Port, in Alleghany county.

Where Youghiogany is traversed by the United States road at Smithfield, the water level is 1405 feet above that of the Atlantic Ocean. The extreme heads of this stream has an elevation exceeding 2500 feet, the mouth being elevated about 700 feet, the entire fall must be 1800 feet. The whole valley of Youghioany is either mountainous or very hilly and broken. Darby.

YOUNG, Edward, a celebrated English poet, was the son of a clergyman, and was born at the living of Upham in Hampshire, in June 1681. From Winchester school he went to New College, Oxford, in 1703, and afterwards to Corpus Christi College in 1708. In the year 1708, Archbishop Tenison obtained for him a law fellowship at All Soul's College.* In this situation he seems to have begun his poetical career by an epistle to Lord Lansdowne in 1712, which was followed in 1713 by his poem of the Last Day, dedicated to Queen Anne. His next productions were, "The Force of Religion, or Vanquished Love," published in 1714; his tragedy of "Busiris, King of Egypt," published in 1719; his tragedy of "The Revenge," published in 1721; his satires, entitled "The Love of Fame, or the Universal Passion," from 1725 to 1788; the "Instalment" in 1726, and his two Odes, one addressed to the king on his accession, and the other entitled "Ocean."

Although he had taken the degree of LL.D in 1719, yet he now conceived the idea of entering into the church, and accordingly, in 1728, he too orders, and in the same year was appointed one the royal chaplains. Owing to this circumstance, he withdrew from the stage his tragedy of the Brothers, which was then under rehearsal. His first theological work was his "True Estimate of Human Life," which was followed by a sermon, preached before the House of Commons, entitled "An Apology for Princes, or the Reverence due to Government." His other works published about this time were his "Imperium Pelagi, a Naval Lyric;" "two Epistles to the Pope concerning the Authors of the Age;" and the Seapiece, in two odes, inscribed to Voltaire.

In the year 1730 he was presented by the college of All Souls to the rectory of Wellwyn, in Herts; and in 1731 he married Elizabeth Lee, daughter of the Earl of Litchfield, and the widow of Colonel Lee. This lady had a son and two daughters, the eldest of whom, called by him Narcissa, died of a decline at Lyons in 1736. Her husband, Mr Temple, son of Lord Palmerston, supposed to be the Philander of the poet, died in 1740, and his own wife died in 1741, leaving him an only son.

These domestic afflictions preyed upon his spirit, and exaggerated that constitutional melancholy to which he was subject. This state of mind led him to the composition of his "Night Thoughts," begun in 1741, and completed in 1747. These noble poems, which he himself justly valued as the chief of his productions, are the work of a truly pious and gifted mind, which had studied and rightly estimated the condition of man. If they are tinged with a shade of what the world calls the gloom of his own mind, we must recollect, that all the objects of his earthly affections had been taken from him, and that he had thus learned to form a right estimate of the highest pleasures of life. In reference to the vices and corruptions which surround it, the most pious mind may feel itself depressed, while, in reference to its own prospects, it is cheerful and serene. When more popular and more attractive poems shall be forgotten, the "Night Thoughts" will be esteemed and admired as the poetical manual of the Christian saint.

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* "His application and learning may be inferred from a singular speech of the atheist Tindal, who spent much of his time at All Souls, and used to argue with him on topics of religion." "The other boys," said Tindal, "I can always answer, because I always know whence they have their arguments, which I have read an hundred times; but that fellow Young is continually pestering me with something of his own."—*Beauties of England and Wales,* Vol. VI. p. 293.

Notwithstanding his domestic sorrows, and his disappointments in relation to church preferment, Dr. Young was regarded as an agreeable and lively companion. After the publication of his "Night Thoughts," his productions were few and unimportant. His "Thoughts on the present Juncture," in 1745, in which he abuses the Scotch for their poverty aud rebellious spirit; his "Centaur not Fabulous, or Six Letters to a Friend on the Life in Vogue;" his "Sermon preached before their majesties," in 1758; and his last production, entitled "Resignation," appropriately terminating his literary career, were the rest of his productions. He died in April 1765, in the 84th year of his age, and was interred in the chancel of the church of Nelwyn, near the body of his wife. His only son, Frederick, erected a monument to his father, with the following inscription:—

M. S.
Optimi Parentes
EDWARDI YOUNG, LL.D.
Hujus Ecclesiæ Rect.
Et ELIZABETHÆ,
Fem. Prænob.
Conjugis ejus Amantissimæ
Pio et Gratissimo Animo
Hoc Marmor Posuit
F. Y.
Filius Superstes.

An edition of Dr. Young's works, in 4 vols. 8vo. was published during his lifetime. See the Rev. Mr Herbert Croft's Life of Young, written for Dr. Johnson, to be published in his Lives of the Poets.

YUCATAN. See MEXICO, *passim*.

YVERDUN, a town of Switzerland, in the Canton de Vaud, situated at the south extremity of the Lake of Geneva, between the river Orbe on the west, and the small river on the east, which runs close to the walls of the old chateau, and is afterwards flanked by a row of trees on each side. The principal buildings are the old chateau, built in the 12th century, and at present occupied by the school of Pestalozzi. It is a quadrangle with circular towers at each angle. The Hotel de Ville is a neat building, with a front of fine Ionic pilasters supporting a pediment. The church, which stands at the angle between two streets, and forming part of both, has a front, with four Ionic columns below, and Corinthian pilasters above them, and Ionic pilasters on the two sides.

Yverdun has a public library, and a collection of natural history and Roman antiquities. Between the town and the lake there is an extensive and beautiful promenade, adorned with fine trees, and commanding an excellent view of the lake.

The canal of Yverdun, after issuing out of the lake of Neuchatel, enters the Orbe by two locks, and then leaves it after some miles. The population of the town is about 2500.

Z.

ZAIRE. See CONGO, Vol. VI.

ZANTE. See IONIAN ISLANDS, Vol. XI. p. 394—396.

ZEALAND. See DENMARK.

ZEALAND, NEW, a name given to two islands of the South Pacific Ocean, situated between 34° 22′ and 47° 25′ south latitude, and between 166° and 180° of east longitude. The most northern is called Eaheinomauwe, and the most southern Tovy or Tavai Poenammoa. The first contains about 26,160 square miles, and the second about 36,000, according to Mr. Nicholas, who visited them in 1814 and 1815.

The general aspect of the islands is undulating, the hills rising into lofty mountains, the highest of which is Mount Egmont, which is said to resemble in appearance and elevation the Peak of Teneriffe. The greater part of the northern island is considered capable of cultivation, but Tovy is mountainous and barren.

The climate of Eaheinomauwe is mild and uniform. The thermometer varies from 74 in summer to 63 in winter. In consequence of occasional showers the verdure never loses its freshness. At the southern extremity of Tovy, heavy and continued rains fell while the Resolution remained in Dusky Bay.

The principal vegetable productions of New Zealand are a variety of noble timber trees, among which are different species of lofty pines, and trees of a lesser size, but consisting of wood of a finer grain. From the Henow tree, the natives extract a black dye, and the others which the natives use, are the *towha*, a tree like the sycamore; the *river river*, a tree with the grain of the beech; the *vow*, a species of cork tree; the *eckoha*, a very large tree, and the *kycata*, a tall and beautiful tree. There are only three species that bear useful fruit. Besides the common fern which yields to the New Zealanders their daily food, there is the fern tree with leaves like the fern, from which they obtain material for food. The root is baked between hot stones as they do their potatoes, and it is then considered as of a superior flavour to turnips. The herbaceous productions are celery, wild parsley, canary grass, plantain grass, a kind of rye-grass, the flag, and the Phormium tenax, a flax plant and a species of fern admirably adapted for cordage. The fibres of this plant, which was first made known by Sir Joseph Banks, are stronger than those of flax or hemp. The following results were obtained by MM. Thouin and Labillardiere:

	Strength of the fibres.	Extensibility of the fibres.
Agave fœtida . .	7	$2\frac{1}{2}$
The best flax . .	$11\frac{3}{4}$	$\frac{1}{2}$
Hemp . . .	$16\frac{1}{5}$	1
Phormium tenax .	$23\frac{5}{11}$	$1\frac{1}{2}$
Silk . . .	34	5

Dr. Yule found that the plant stood three winters in Edinburgh, in different situations nearly 225 feet above the sea. Hence if it could be cultivated in the south of England, or even imported from our Australasian settlements, it would be an object of great use in our navy, and for other purposes in the arts.

The esculent plants are the potato, cabbage, turnip, and a kind of yam. Indian corn is their only grain. The pumpkin is cultivated for the purpose of converting it into drinking vessels.

There are comparatively few animals in New Zealand. The only quadrupeds are the sea lion, the guiana, a lizard, the sea bear or ursine seal, a small bat, and the rat. The birds are the Poe with delightful notes, the parrot and parroquet, a fine duck with red bill, legs and feet, and a black body, the gannet, the albatross, the petrel, rails, cormorants, penguins, &c. Almost all sorts of domestic fowls have been introduced by the missionaries.

Every creek abounds with fish, among which are mackarel, the lobster or sea cray fish, the elefant, the dog fish, flat fish like soles and flounders, eels and congers, and clams, cockles and oysters.

In 1814 the Rev. Mr. Marsden established the first missions in New Zealand. He visited the settlements in 1819, when a tract of land of 13,000 acres was purchased from one of the chiefs as a settlement. In travelling across the island, Mr. Marsden discovered a large river, the Gambier, with its tributary streams, flowing into the sea. The missionaries under the superintendence of this pious and enterprising individual, have succeeded in reducing the language of the natives to writing, and in constructing a grammar to it.

The character and manners of the natives, and the history of geographical discovery in reference to these islands, have been already sufficiently discussed in our article Australasia, Vol. III. The population of New Zealand has been estimated at between 100,000 and 150,000.

ZELLE, or Celle, a city of Germany, in the kingdom of Hanover, is situated at the confluence of the river Fuhse and Aller. The last of which is here navigable. The town is fortified and well built, and is encompassed with a mound and moat. The town is beautiful, particularly the new town and suburbs. The ducal palace is surrounded with a separate wall and ditch, and was the residence of the Zelle line of Brunswick Luneburg, which failed in 1705. The unfortunate Queen of Denmark resided in it from 1772 till her death in 1775, when a monument by Oeser, of Saxon marble, was erected to her memory in the Royal garden, which is the public promenade. The principal church contains several curiosities, and the tomb of the Queen of Denmark. The other buildings and institutions in Zelle, are a lunatic hospital, an orphan house, a poor's house, a school of surgery and an agricultural society. The Court of Appeal for the kingdom of Hanover is held here, consisting of two deputies from each province.

Zelle carries on a small trade similar to that of Hanover. Its bougies are celebrated, and a great many are employed in bleaching linen. The inhabitants, who are chiefly Lutherans, amount to about 8200.

ZENITH, Sector. See Sector Zenith.

ZEOLITE. See Mineralogy, *Index.*

ZETLAND. See Shetland.

ZEUXIS. See Painting, Vol. XV. p. 281.

ZINC. See Chemistry, *Index*, Metallurgy, and Mineralogy, *Index.*

ZIRCON. See Mineralogy, *Index.*

ZIRCONIA. See Chemistry, *Index.*

ZODIAC. See Astronomy.

ZODIACAL Light. See Astronomy, Vol. II. p. 581, &c.

ZOOLOGY. See Natural History.

ZOOPHYTES, *Zoophyta*, (from ζωον *an animal*, and φυτου *a plant*) is a term applied by naturalists to a class of aquatic animals of a plant-like form, and very simple internal structure. Next to the Infusoria in the simplicity of their internal organization and in the multiplicity of their superficial absorbing orifices, the true ramified Zoophytes compose the second lowest class of the animal kingdom. They present no muscular nor nervous system, nor organs for circulation, respiration, or secretion, and from the gemmiparous nature of their generation, they possess no trace of sexual or generative organs. The Zoophytes form a very numerous and diversified class, and from the variety, beauty, and symmetry of their forms, the novelty and singularity of their living phenomena, their uses in domestic economy and the arts, and their importance in the economy of nature, they constitute one of the most interesting and remarkable divisions of the animal kingdom. (See Zoophytology, Class III.

ZOOPHYTOLOGY.

ZOOPHYTOLOGY, (from ζωον *an animal*, φυτον *a plant*, and λογος *a discourse*) is that branch of natural history which treats of zoophytes, or animals of a plant-like form.

Although the term zoophyte is usually confined to those ramified, fixed, compound animals composing the second lowest class, we shall avail ourselves of the more extended sense in which the term is used by Cuvier, to lay before our readers in the present article a brief systematic view of the four classes, Entozoa, Radiata, Zoophyta and Infusoria, which that distinguished naturalist has comprehended under this term. The great division of the animal kingdom composed of these four classes is called Radiata by Cuvier, from the animals exhibiting very often a radiated form of the whole body, or of some of its parts. The same general character is expressed by the term Actinozoaires (from ακτιν *radius*, and ζωον *animal*) more recently applied to this division by Blainville. These animals formed only a part of Linnæus's great class Vermes. They are termed Apathica by Lamarck, from their being all destitute of organs of sense and even of nerves, and from his considering their motions to be mere automatic phenomena not accompanied with feeling. They form the division called Acephala by Latreille from their having no part analogous to the head of the articulated classes. From the Acalepha downwards are comprehended under Dr. Grant's division Aneurosa, so named from their exhibiting no trace of nervous filaments.

The external form of the animals belonging to this great division is infinitely more diversified, and often much more complicated than that of the higher classes, but they possess a more simple organization, and have fewer functions to perform. They possess no red blood nor internal articulated skeleton, nor brain, nor spinal marrow, nor heart, nor pulsating dorsal vessel, nor a complete circulation, nor glands for secretion. The Entoza alone exhibit longitudinal nervous filaments like those of Cuvier's Articulata, or Dr. Grant's Neurosa. The nerves in the Radiata radiate from ganglia placed around the œsophagus, as in the Molluscous or Gangliated classes. A partial circulation is observed only in these two classes. The respiration is partial and aquatic, and is effected by organs which ramify through the body like air-vessels of articulated animals. The muscular fibres are distinct in the Entozoa, but scarcely discernible in the inferior classes. The skeleton is often internal, but more frequently external. None possess articulated organs for locomotion. Organs of generation and a distinction of sex have been observed only on a very few of the Entozoa. In the other classes all the individuals are alike capable of reproduction, and their mode of generation is either gemmiparous or fissiparous. Latreille has been misled by the erroneous observations of Spix to consider the reproductive gemmules of these animals as similar to the ova of the higher classes. The development of the so-named ova of the radiated animals has not yet been satisfactorily observed, but it is known that some of them possess spontaneous motion when newly separated from the parent, as in the gemmules of zoophytes. The Entozoa have generally a lengthened serpentine form, the Radiata are circular and depressed, the Zoophytes are ramified, and the Infusoria approach to the spherical form. The Entozoa are small, white, soft, naked animals, found only in the bodies of other animals. The Radiata are found creeping at the bottom of the sea, or floating in myriads upon the waves. The Zoophytes decorate with their elegant arborescent forms every thing which lies beneath the surface of the ocean; they prefer the calm recesses of the deep, and hang in countless numbers from the roofs of submarine caves. The Infusoria abound wherever there is moisture on this planet, whether exposed to the atmosphere, as in rivers, lakes and the ocean, or shut up in the bodies of animals or plants.

CLASS I.—ENTOZOA. RUDOLPHI.

The animals of this Class are parasitic, and are found only in the bodies of other animals. The Entozoa, or intestinal worms, are characterised in general by their want of an external or internal skeleton, by their naked, smooth, and elastic integument, by their very languid irritability, by their lengthened vermiform body, and by their very simple internal structure.

The external surface of the body is generally covered with a tough elastic and almost transparent homogenous integument. In some, as the Tænia, the body is divided by numerous transverse depressions, or articulations, like the surface of the annelides. Muscular fibres have been observed in some of the species, forming two layers within the integument, the outer composed of transverse circular fibres, and the inner formed of longitudinal interrupted fibres extending along the body. Nerves have also been observed in a few species, forming two simple lines, the one running longitudinally along the abdomen, the other along the back, and sometimes they appear to extend round the œsophagus. The intestinal canal extends in a straight line along the body, without cœca or convolutions, and has generally an anus distinct from the mouth. The mouth in the highest order, Entomoida, presents a proboscis adapted for sucking, with rudimentary maxillæ, and even jointed antennæ. Eyes, and a system of circulation are said to exist in some of the remarkable epizoa belonging to this order. Distinct organs of respiration have not been observed, and it is very probable that their soft texture is originated by the fluids of the animals in which they live. Certain vessels passing longitudinally along the body are considered by some as tracheæ for aquatic respiration, by others as vessels for circulation, and by others as cœca from the intestinal canal. In the greater number of these animals the mouth is furnished with numerous sharp, hard, recurved teeth, by which they attach themselves to, and pierce through the bodies of animals. The most remarkable feature of their organization is the existence of separate sexes in beings of so simple a structure. A long convoluted spermatic vessel, a seminal receptacle, and a projecting stiliform tubular body, have been observed in the male of some species, and in the female a kind of vulva communicating with an interior uterus, and two long slender white convoluted ovaria. In the Entomoida the two ovaria generally hang externally from the posterior extremity of the body. Not only have the sexual organs been minutely described by several observers, but the animals have been seen to copulate.

The consideration of this class of animals is interesting from the great variety of forms and structures they present, from the equivocal nature of their origin, and from the ravages they commit in the bodies of man and the inferior animals. Some naturalists, as Blumenbach, Lamarck, Mekel, &c. suppose them to originate spontaneously from the mere elements of the bodies in which they are found. Others suppose them to originate from animals taken in with the food or drink, and changed in form by the change of the medium in which they live. Others suppose them to originate from germs contained in the ovum, and thus transmitted by generation. They are found in animals, attached to the surface of the body, the lips, the fauces, the cornea of the eye, the interior of the stomach and intestinal canal, the bronchiæ, or the ducts leading from the intestine. They are found imbedded in the cellular texture of the extremities, in the muscular substance of the body, in the parenchyma of all the internal organs, and even in the brain itself. These singular animals have engaged the attention of several eminent naturalists, and of many of the older medical writers. Redi has figured and described several intestinal worms occurring in the lowest classes of animals, (an. 1671). Daniel Clerc published at Geneva in 1715 an elaborate treatise on these animals, illustrated with numerous magnified engravings (Hist. Nat. et Med Latorum Lumbricorum). Linnæus described only eleven species of intestinal worms in the last edition of his Systema Naturæ. Pallas has described the characters of several species of the genus Tænia. One of the most valuable works, however, which has yet appeared on this tribe of animals, is the elaborate natural history of intestinal worms published at Blankenburg in 1782 by J. A. E. Goeze, honorary member of the natural history society of Berlin, (Versuch einer naturgeschichte der eingeweidewürmer thierisher körper). This laborious and original work describing the dissected specimens of these animals in the author's extensive cabinet, is illustrated with 44 beautiful quarto engravings, containing several hundred magnified objects. The numerous and accurate figures and descriptions of Goeze have formed the chief basis of all succeeding classifications of these animals. At the same time with the work of Goeze, a treatise on intestinal worms, and chiefly on the tæniæ of the human body, was published by P. C. F. Werner at Leipsic, in one volume 8vo. with plates, and in the same year, 1782, M. E. Bloch published a medical treatise on these animals in 4to with 10 plates, at Berlin. In 1786 the Bibliotheca Helminthologica was published by Modeer at Erlangen, and in the same year A. I. Retzius printed his public lectures on intestinal worms chiefly from the human body, at Holm. Cuvier in his Tableau Elementaire, 1798, described a few of the genera, and placed them after the annelides at the bottom of his great division of animals termed Insects and Worms. In his Regne Animal, 1817 and 1830, he has placed them below the Echinedermata in the great division of Zoophytes, and divided them into two sections, viz. Cavitaires, (Nematoidea of Rudolphi), and Parenchimateux (comprehending the four last orders of Rudolphi). Bruguière, in the article Vers of the Encyclopedie Methodique, has given an extensive series of accurate engravings illustrative of this class of animals, and a collection of folio lithographic plates, containing copies of all the more recent figures of Entozoa, has been just published in Germany. I. G. H. Zeder published at Bamberg in 1803 an introduction to the natural history of intestinal worms, in 8vo. with plates, in which work 391 species are enumerated. In the natural history of intestinal worms published at Amsterdam by Rudolphi in 1808-1810, in 2 vols. 8vo., 603 species are enumerated; and in his Synopsis Entozoorum published at Berlin in 1819, he has enumerated more then eleven hundred species. The classification of Entozoa proposed by Rudolphi in this Synopsis, which is nearly the same as Zeder's, is that most generally adopted by naturalists, and it has been recently illustrated by a series of 18 folio engraved and coloured plates, executed under the direction of Dr. Bremser of Vienna. The French translation of the work of Bremser on the human entozoa has been enriched with numerous interesting observations by M. Blainville. An interesting memoir on the anatomy of two species of intestinal worms was recently presented to the French Institute by Professor J. Cloquet, and has been published in a separate form, illustrated with numerous highly magnified views of the internal organs. Blainville, Deslongchamps, and several other writers have likewise illustrated the structure of these animals. The classifications of Entozoa adopted by Lamark, Goldfuss, Schweigger, Latreille, and other modern systematic authors, are founded on the system of Rudolphi, which we shall therefore lay before our readers in this article, with the addition of the Order Entomoida, composed of those more complicated species which reside generally on or near the surface of aquatic animals. M. Latreille has given a very distinct and interesting view of the classification of these animals and their various relations, in his Familles Nat. du Reg. An. 1825. The class of Entozoa is divided into six Orders, founded on the external form of the animals, the internal structure not affording as yet any convenient basis of classification. The six Orders are, 1. Entomoida, 2. Nematoidea, 3. Acanthocephala, 4. Trematoda, 5. Cestoidea, 6. Cystica.

ORDER I. *Entomoida, Latreille* (from εντομον insecta).

The animals belonging to this order were termed Epizoariæ by Lamarck from the parts of the body to which they are generally found attached, and he comprehended them under the three great genera Entomoda, Lernæa, and Chondracanthus, which have since been much subdivided. The term Entomoida is applied to them by Latreille, and points out their remarkable affinities to the class of insects in the divisions of their body and in their external organs. They form a link of transition from parasitic insects which move freely to and fro on the surface of animals, to the true entozoa which remain deeply buried in the substance of their bodies. In their articulated appendices some of the species, particularly of the Lernææ, have a close resemblance to the branchiopodous crustacea. The Entomoida are found attached only to the surface, or partially buried in the superficial soft parts of aquatic animals, while the rest of their body hangs constantly exposed to the action of the external element. From this partially exposed situation they partake of a mixed life, and exhibit a combination, in the same individuals, of the forms and organs both of insects and intestinal worms. Like these worms they possess a very simple internal organization, a soft, elastic, naked, and feebly irritable body; they are permanently fixed to the animals on which they feed, and they live by sucking the internal fluids. From their external situation they have not only organs for piercing and sucking the animal substance like entozoa, but also parts variously constructed for attaching themselves to the surface of the body like insects. Some possess piercing organs, placed on appendices extending like tentacula from the head, some present at the sides of their prosbocis the rudiments of jointed antennæ, and some of the species are said to have sessile eyes. They possess a tough elastic integument, distinct muscular and nervous filaments, a simple intestinal canal, with a mouth and anus distinct. The mouth is in form of a proboscis, and is generally provided with curved hooks, tentacula or antennæ. Their two ovaria hang externally from the posterior extremity of the body, and in several of their characters the Entomoida are allied to the parasitic branchiopodous crustacea, but they present no appearance of branchiæ or other organs of respiration, and they do not appear to change their external covering like crustacea. The structure of these singular parasitic animals is still very imperfectly known. M. Blainville has published an interesting memoir on the structure and classification of these animals in the Journal de Physique for 1822, and Professor Grant has described the anatomy of a remarkable species from the Arctic seas, in the Edinburgh Journal of Science, Vol. VII. The following genera of this order have been chiefly formed by M. Blainville from the subdivision of the three great genera already mentioned, and they have been recently adopted by Latreille, viz.

1. Lernantropus.
2. Lerneopoda.
3. Lernacanthus.
4. Lernentoma.
5. Lerneopenna.
6. Lerneocerus.
7. Lerneomisus.
8. Lernœa.
9. Foroculum.

ORDER 2. *Nematoidea, Rudolphi.* (νημα filum.)

The worms belonging to this extensive order, are chiefly characterised by the lengthened, slender, and cylindrical form of their body, and by their total want of sharp recurved spines around the mouth. From their want of spines or teeth, they are termed by Latreille Anodonta. They have a simpler form and internal structure than the preceding order, their mouth presenting no rudimentary antennæ or other appendices, and although the nervous system in some of the species is allied to that of the annelides, they do not possess setæ or other organs of motion extending from the sides of the body. The body is covered with a smooth elastic integument, within which are a transverse and a longitudinal layer of muscular fibres. The intestinal canal has a mouth and arms placed at its opposite extremities, and the sexes are on separate individuals. The Guinea worm (Filaria Medinensis) is the type of this order, and it comprehends according to Rudolphi the following genera.

1. Filaria.
2. Trichosoma.
3. Trichocephalus.
4. Oxyurus.
5. Cucullanus.
6. Spiroptera.
7. Physaloptera.
8. Strongylus.
9. Ascaris.
10. Ophiostoma.
11. Liorhyncus.

ORDER 3. *Acanthocephala, Rudolphi.*

This order comprehends only the genus Echinorhynchus, of which there are nearly a hundred species. They are named Acanthocephala, (from ακανθα spina,) from the reverted hooks disposed in series around their retractile proboscis. The body has the lengthened, slender, cylindrical form and elastic consistence of the preceding order, and the sexes are placed on separate individuals. The common Echinorhynchus gigas, which occurs in the small intestines of the wild and domestic hog, is one of the largest intestinal worms, and its anatomy has lately been the subject of an interesting memoir by Jules Cloquet. It possesses distinct transverse and longitudinal muscular fibres within the elastic integument, the nerves are doubtful. The anterior part of the body, which is the broadest, is terminated by a spherical perforated canal, but the food appears to be introduced both by the proboscis and by superficial pores. The sexes are separate. The male organs consist of two curved cylindrical testicles, two vasa differentia, which unite and terminate in a single vesicula seminalis, and a long cylindrical straight tubular and exsertile penis. The female organs are two long wide cylindrical ovaria, which fill nearly the whole of the body, and a single oviduct.

Genus 1. Echinorhynchus.

Order 4. *Trematoda, Rudolphi.*

The worms of this order named Trematoda by Rudolphi (from *τρημα* foramen), are chiefly distinguished by their having one or more simple pores adapted for sucking. They are generally of an irregular form, of a soft texture, very minute, and with a depressed body. There is sometimes a single pore, sometimes there are several, placed at the anterior or on the lower part of the body, and not provided with recurved spines for piercing. To this order belong the genera.

1. Monostoma.
2. Amphistoma.
3. Distoma.
4. Tristoma.
5. Pentastoma.
6. Polystoma.

Order 5.—*Cestoidea, Rudolphi.*

The name given to this order by Rudolphi is derived from the Greek word *σης tinea*, and is applied to those entozoa which have an elongated, flat, tape-like form of body, as the common Tænia solium found in the human intestines. The body is depressed, softer than the filiform species, and generally divided by transverse depressions presenting the appearance of a series of articulations, like the annulose animals. The head is generally provided with two or four apertures, adapted for sucking, and in a few the head appears simply lobed. The sexes appear to be united in the same individuals. Zeder considered the sexes as separate in some of the species where other naturalists have been unable to detect that distinction. The genera belonging to this order are

1. Caryophyllæus.
2. Scolex.
3. Gymnorhynchus.
4. Tetrarhynchus.
5. Ligula.
6. Triænophorus.
7. Bothriocephalus.
8. Tænia.

Order 6.—*Cystica, Rudolphi.*

This order comprehends the simplest known Entozoa, in which we observe no distinct internal organs for digestion or generation, and no distinction of sex has been observed in any of the species. The body is generally short, slender, cylindrical, or depressed, and terminated posteriorly by a wide vesicle. Some are found enclosed solitary in shut cysts, to which they do not in any part adhere. The vesicle which terminates the body posteriorly is generally filled with a transparent thin fluid, and the anterior extremity of the animal is provided with sucking pores, and a mouth surrounded with sharp recurved teeth for piercing. The different kinds of Hydatids which abound so much in the digestive organs of ruminating and Pachydomatous animals, are examples of the Entozoa belonging to this order. Rudolphi comprehends under the order Cystica (from *χυστις vesica*) the four following genera, viz.

1. Anthocephalus.
2. Cysticercus.
3. Coenurus.
4. Echinoccus.

CLASS II.—Radiata, *Lamarck*.

The animals of this numerous and diversified class are not parasitic like those we have last considered, they often acquire a great size, and exhibit a complicated external form, with a complex internal organization. They are aquatic animals residing mostly in the sea, some move freely to and fro through that element, others only creep along the bottom, and some remain fixed to submarine bodies. They are particularly distinguished by the radiated disposition of the whole body, or of some of its parts. Several present distinct nerves and ganglia, disposed in a circular manner around the entrance to the stomach. The stomach sometimes terminates in an intestinal canal connected by a kind of mesentery to the parietes of the body, and ending in a separate anus, as in the Echinus and Spatangus. In others, as the Asterias, the stomach has but one aperture, and sends out numerous ramified cœca to the different divisions of the body. In some of the Medusaria the stomach has several external orifices, and numerous passages extends from its parietes through the substance of the body. In some of the radiata vessels for a partial circulation are observed forming plexuses round the stomach, and respiratory organs in form of minute absorbing tubes, are sometimes seen spread over the surface. No distinction of sex is observed in these animals or organs for impregnation, and the ovaria which they possess appear destined to an ovo-gemmiparous kind of generation. A few of these animals afford a palatable nutriment, as the ovaria of the Echinus esculentus. They constitute the food of the largest animals of the globe—the whales. They produce the luminosity of the sea by night, and from their abundance they often change its colour by day. They afford a rich manure, and are often collected in immense quantities for this purpose in France, and in this country among the exuvia of the sea, to be spread upon the land. For the illustration of this interesting class of animals we are chiefly indebted to the labours of Leske and Klein for the Echinoida, Linck and Teidemann for the Asteroida, Reaumur and Dicquemare for the Anthoida, Muller, Forskael, Basterus, Cuvier, Peron, Lesueur, and Rosenthal for the Medusaria. And the industry of Buguierè and Lamarck have been advantageously directed to this class. Cuvier has distributed these animals into two classes, Echinodermata and Acalephæ, the former, instituted by Bruguierè for those species, which, like the Asterias and Echinus, are covered externally with calcareous spines; and the latter class, instituted by Cuvier, for the naked Radiata, which, like the Medusæ and Actinia, have a stinging quality when they touch the naked hand in their living state. Lamarck has placed them under the same class Radiata. The orders of this class are natural families, which derive their names from those of their typical genera. They are five in number, viz. Holothurida, Echinoida, Asteroida, Anthoida and Medusaria.

ORDER 1.—*Holothurida, Latreille.*

The animals of this order have generally a lengthened, subprismatic body, covered with a highly irritable elastic and coreaceous integument. The mouth and anus are distinct, and placed at the opposite extremities of the body. The mouth is often surrounded with numerous extended ramified tentacula capable of retraction. The respiratory organs consist of numerous internal ramified aquatic canals, which terminate in the anus, they commence on the surface by minute absorbing fleshy tubes. Sometimes the mouth is furnished with osseous pieces, and teeth like those of an Echinus. In the Holothuria and some other genera of this order, the body is furnished with numerous cylindrical retractile papillæ, disposed in longitudinal rows along the outer surface, and serving as feet for progressive motion. These organs, however, are variously disposed in the different genera. They are marine animals, and are found free and solitary at the bottom of the sea. Their nervous system presents several ganglia connected by nervous filaments, and disposed around the entrance to the intestinal canal. The genera belonging to this order are,

1. Bonellus.
2 Sipunculus.
3. Minyas.
4. Priapulus.
5. Molpadia.
6. Holothuria.
7. Actinopus.
8. Fistularia.
9. Phantapus.
10. Phalloides.

ORDER 2.—*Echinoida, Latr.*

The Radiata of this order have the body of a globular ovoidal or depressed form, covered with a calcareous shell, to the surface of which are articulated numerous movable conical spines. The organs of motion in form of fleshy cylindrical tubes or suckers extend from minute perforations disposed in a radiated manner along the shell. The mouth is generally furnished with a complicated osseous frame-work containing five teeth lodged in alveoli. The intestine extends from the mouth in a convoluted form attached to the sides of the body by a distinct mesentery, and the anus is always distinct from the mouth. Vessels for a partial circulation are seen extending along the course of the intestine and on the mesentery. These animals are marine, and they exist free and single. They present no distinct organs of sex, but possess all equally ovaria, which open, each by a separate orifice, generally around the anus. The ovaria are the parts which are eaten in the common sea urshin, or Echinus esculentus. The genera of this order are,

1. Echinus.
2. Cidaris.
3. Echinoneus.
4. Galerita.
5. Nucleolites.
6. Cassidula.
7. Fibularia.
8. Clypeaster.
9. Scutella.
10. Ananchites.
11. Spatangus.
12. Brisoides.
13. Brissus,

ORDER 3.—*Asteroida, Latr.*

The animals of this order are distinguished by the star-like form of their body, which is divided into a variable number of rays. The mouth is situate in the centre of these rays, and on the lower surface as in most other Radiata. There is no anus distinct from the mouth, but numerous ramified cœca extend from the sides of the stomach into all the arms, to the sides of which they are connected by a mesentery. The respiratory organs are minute cylindrical retractile tubes, disposed on the upper surface of the body as in the preceding orders, and which convey water into the interior of the body. Vessels are seen forming a plexus round the stomach, coming from the mesentery and passing towards the aquatic tracheæ, apparently for a circulation. And in the asterias ganglia are observed disposed around the stomach, connected by filaments, and sending nerves to the stomach, to the arms, to the organs of respiration, and to the skin. The ovaria, like a double cluster of grapes in each arm, terminate in two ducts at the place of junction of each of the arms. They have no organs of sex or for impregnation. The Asteroida are all marine animals, and from their vast abundance they are employed as a manure on the coasts of this country and of France. Their forms are remarkably regular and symmetrical, and their colours in the living state are lively and often beautifully variegated. The genera of this order are,

1. Asterias.
2. Ophiura.
3. Comatula.
4. Euryale.
5. Pentacrinus.
6. Encrinus.

ORDER 4.—*Anthoida, Gr. (Helianthoida, Latr.)*

The animals of this order, like the Holothurida, have generally a lengthened cylindrical body, covered with a coreaceous contractile and highly irritable integument. Like the Asteroida they have no anus distinct from the mouth. The disposition of their tubular tentacula in several rows around the mouth, their circular form, and the beautiful colours which decorate their surface, give them the appearance of flowers, from which the name of the order is derived. They are marine animals, and remain attached spontaneously by their base to submarine bodies. They feed on testaceous and other animals, which they seize with their tentacula when brought within their reach by the tide or other acident, and the tentacula and whole upper surface of their body is for this purpose covered with a very adhesive, thick, glutinous secretion. In the Actiniæ nerves are seen around the base of the stomach, and the ovaria lie between the stomach and the perpendicular folds of the parietes of the body. The young are produced already formed, and pass out through the stomach. They compose the order of fixed Acalephæ of Cuvier. The genera of this order are,

1. Actinia.
2. Zoanthus.
3. Lucernaria.

ORDER 5.—*Medusaria.*

The animals of this order, though of a more complicated external form, have a much simpler internal structure, and much more imperfect vital properties than those of the preceding orders. They possess no external nor internal skeleton, and exhibit no trace of nervous or muscular fibres. They are marine animals of a soft gelatinous transparent texture, and move freely to and fro, supported in the water by the contractility of their fleshy substance, aided in some of the species by vesicles filled with air. There are sometimes several entrances to the stomach, but there is no anus distinct from the mouth. They have no distinct organs of circulation or respiration, but vessels or cœca are observed proceeding from the stomach and ramifying through the substance of the body. Many of these animals present beautiful contrasts of colours in their transparent texture, and elegant external plant-like forms. They appear to abound chiefly in the colder latitudes of the ocean. They often change the colour of great tracts of the sea from their abundance. They produce the sparkling luminosity often observed by night in the agitated waves of the ocean. They serve as the food of whales, whose masticating organs appear to be adapted for no other kind of food. They present a kind of ovo-gemmiparous generation, and the ova of the Medusa Aurita have been observed to possess a power of spontaneous motion when first separated from the parent, as in Zoophytes. They have no apparent organs for impregnation, nor any distinction of sex. The mouth is in the centre of the lower part of the body, and is generally surrounded with numerous ramified appendices. Many of those animals possess a stinging property when touched in the living state with the naked hand, hence the term applied to them by Cuvier, Acalephæ (from ἀκαλήφη a nettle). The genera of this order are,

1. Beroe.
2. Callianira,
3. Ceste.
4. Diphia.
5. Porpita.
6. Vilella.
7. Noctiluca.
8. Physalia.
9. Physsophora.
10. Rhizophysa.
11. Sephanomia.
12. Medusa.
13. Equorea.
14. Foveola.
15. Phorcynia.
16. Cyanea.
17. Rhizostoma.
18. Aurelia.
19. Cassiopea.
20. Lymnorea.
21. Favonia.
22. Geryonia.
23. Berenice.
24. Eudora.
25. Carybdea.

CLASS III.—Zoophyta.

The animals of this class present a more complicated and diversified external form, but a more simple internal organization than those of the two preceding classes. They are aquatic animals of a plant-like form, generally compound, and fixed by their base. They possess no distinct organs of sense, nor any trace of a nervous, muscular, or circulating system. Their digestive organs consist of numerous small superficial sacs termed polypi, having a single aperture, surrounded with tentacula or cilea, for attracting and seizing prey. They have generally a spreading base, a stem and branches, and shoot up from the bottom of the sea, or hang from the roofs of submarine caves, or are attached to plants, rocks, shells, or other submerged substances. Their body is for the most part supported by an axis or skeleton composed of cartilaginous, horny, calcareous, or silicious substance. The soft parts have a simple gelatinous texture and soft consistence, destined for the function of digestion, and exhibiting no distinct organs either for secretion or generation. Zoophytes are gemmiparous, some generating by the discharge of internal gemmules, and others by forming gemmules on their surface, which separate when they have attained maturity. The internal gemmules have an ovoidal or round form, and soft gelatinous consistence like small ova, and appear, from the observations of Dr. Grant on the zoophytes of the Frith of Forth, to be almost always ciliated on the surface, and capable of moving to and fro in the water, by the rapid vibration of their cilia for some time after their separation from the body of the parent. The small apertures on the surface of Zoophytes for lodging the polypi are called *cells*, the capsules for containing the gemmules are named *vesicles*, the arms which surround the mouths of the polypi are the *tentacula*, and the very minute vibratory processes like short hairs which fringe the tentacula are the *cilia*. The cells of zoophytes are permanent parts, and their forms afford the most useful characters for distinguishing the species and genera. The vesicles for containing the gemmules in the flexible horny zoophytes appear only at particular seasons of the year, and fall off when the gemmules have escaped. In some zoophytes, as the Flustræ and Cellariæ, the reproductive gemmules are formed in the cells of the polypi, and the polypi and gemmules succeed each other repeatedly during the life of the animal. There are sometimes more than one row of tentacula round the mouths of the polypi, as in Tubulariæ, Caryophylliæ, &c.; most frequently there is but one row, consisting of from 6 to nearly 30 tentacula; 8 is a frequent number in the most highly organized species. In some of the simplest zoophytes the tentacula are entirely wanting. The cilia are generally disposed around the margins of the tentacula; in most zoophytes they are vibratory, causing, by their motions, currents in the surrounding water to flow towards the mouths of the polypi. As the fixed condition of zoophytes prevents them from moving to and fro like other animals in search of food, the cilia are adapted to bring it to their mouths from a distance. The cilia are very numerous on each tentaculum, and move with incalculable rapidity. Sometimes more than two thousand cilia are observed on a single polypus, and we have calculated more than three hundred millions of vibratory cilia on a single specimen of the *Flustra foliacea*. When there are no tentacula, the cilia are disposed around the entrance of the digestive sac, as in Vorticellæ. Like other gemmiparous animals, zoophytes have no distinction of sex. In many of the genera the gemmules make their appearance in clustres at the base of the polypi, and pass out through their bodies.

Zoophytes appear to feed principally on Infusoria, they required only the existence of that class to prepare the sea for their creation, and their remains form the oldest fossil animals met with in the strata of the earth. They are used in medicine, in domestic economy, and in the arts. Corals are formed into various ornamental articles. The sponge is a valuable article of commerce, and extensively used in the arts. Madrepores are used as building materials in countries where limestone is scarce, and many calcareous zoophytes are used as manure. Rocks, bays, and fertile islands owe their existence to these animals in tropical seas. They organise matter for the digestive organs of higher animals, particularly for the mollusca and the minutest crustacea. They precipitate, in form of a carbonate, an immense quantity of lime continually pouring by rivers, in a soluble form, into the bed of the ocean, and thus prepare the abyss for the maintenance of vertebrate animals.

The interesting researches of Imperati, Marsigli, Donati, Peysonnel, Cavolini, Olivi, and Schweigger, on the species of the Mediterranean, those of Trembley on the Hydræ, those of Reaumur, Jussieu, and Lamouroux on the species of the coast of France, those of Peron and Lesueur on the Zoophytes of the southern hemisphere, and, above all, those of our countryman Ellis, on the species of the British coasts, have greatly extended our acquaintance with the structure and economy of this class of animals. The useful labours of Bruguiere and Esper, the accurate and detailed descriptions of Pallas, the elaborate and interesting details of Lamouroux, and the acute discriminations and beautiful views of Lamarck, have eminently contributed to determine the true relations of these animals to each other, and advance the natural history of zoophytes. The following orders are founded on the divisions pointed out by Lamarck, and for the most part retain the names and the order of succession that distinguished naturalist has assigned them.

ORDER 1.—*Calamoida, Gr. Calamides, Latr. Natantia, Lamarck.*

The zoophytes of this order have been erroneously conceived to possess the power of swimming to and fro in the sea by the sudden elevation and depression of their lateral pinnæ, or by the successive strokes of the arms of the polypi, and they were thence termed polypi natantes by Lamarck. They are all marine animals, of a lengthened form, and possessing an internal calcareous axis. Their polypi have eight tentacula disposed in a single row around the mouth, and their cilia are long and not vibratory. They are not attached by their base, but either lie loose at the bottom of the sea, or are carried to and fro by the waves. The united bodies of the polypi form the principal fleshy part of the zoophyte, and the reproductive gemmules which make their appearance first at the bases of the polypi, pass out through the mouths of these organs, as we have observed in the *Pennatula phosphorea* and *Virgularia mirabilis.* These gemmules in several of the species are ciliated on the surface, and possessed of spontaneous motion. They are named Calamoida from their resemblance, in form, to a quill or feather. To this order belong the genera.

1. Pennatula.
2. Virgularia.
3. Veretillum.
4. Umbellularia.
5. Renilla.
6. Funiculina.

ORDER 2.—*Tubifera, Lamarck.*

This term is applied by Lamarck to a small group of zoophytes, the polypi of which are enveloped by distinct tubes which open on the surface of the body. They are fixed zoophytes, with a fleshy contractile body, and without a calcareous axis. The polypi in this group have, like those of the preceding order, eight tentacula around the mouth, and the cilia of these tentacula are not vibratory organs, but appear to be only supplementary to the tentacula. The ova or gemmules of the *Lobularia* are ciliated on the surface, and pass out through the bodies of the polypi as in the preceding order. The genera of this order are,

1. Lobularia.
2. Ammothea.
3. Xenia.
4. Anthelia.

ORDER 3.—*Carnosa.*

The body is composed of a soft gelatinous substance, supported by a fibrous axis of a cartilaginous, horny, calcareous or silicious nature. Some, as the Alcyonium, have distinct polypi with numerous tentacula furnished with vibratory cilia; others, as the Halina and Leucalea have no polypi, and appear to have the cilia disposed on the sides of internal canals passing through every part of the body. In this order alone we meet with a silicious axis, and a soft gelatinous body almost destitute of irritability. The ova or gemmules in the most inert genera of this order, are ciliated on the surface, and swim by the vibration of these cilia, as in the other orders. The genera of this order are,

1. Alcyonium.
2. Geodia.
3. Tethya.
4. Cliona.
5. Spongia.
6. Leucalia.
7. Halina.
8. Flabellaria.
9. Penicillus.

ORDER 4.—*Corticifera, Lamarck.*

In the zoophytes of this order there is an internal axis of a calcareous or horny nature, sometimes regularly jointed. The axis is covered with a soft irritable fleshy substance, in which the polypi have their cells, there are consequently no cells observed on the internal axis. From the experiments so often and carefully repeated by Cavolini on the living *Gorgonia verrucosa*, in the bay of Naples, it is obvious that the fleshy crust of these zoophytes is the most essential and important part—the part which secretes the successive layers of the axis, and forms the polypi. The polypi have eight tentacula, and the reproductive gemmules pass out through the bodies of the polypi. The gemmules of the Gorgonia move by means of their cilia. The red coral of commerce belongs to this group of zoophytes. The Corallina, generally placed in this order, appears, from the experiments of Professor Schweigger of Konigsberg to be only a calcified plant. The genera of this order are,

1. Gorgonia.
2. Antipathes.
3. Isis.
4. Melitæa.
5. Corralium.

Order 5.—*Lamellifera, Lamarck.*

This extensive order comprehends most of the large and elegant tropical species of the calcareous zoophytes, whose vast operations in the seas of the southern hemisphere are so well calculated to excite our admiration, and to interest the attention of the navigator. They have a calcareous axis, often of great density, and marked on the surface with radiated, stellular, or undulated impressions formed by thin elevated lamellæ. In the recent state the whole body is covered with a soft gelatinous flesh, in which the polypi are lodged. The gemmules are formed in clusters at the base of each polypus, and pass out through these organs. The genera of this order are,

1. Oculina.
2. Seriatopora.
3. Madrepora.
4. Pocillopora.
5. Porites.
6. Astrea.
7. Explanaria.
8. Echinopora.
9. Monticularia.
10. Meandrina.
11. Agaricia.
12. Pavonia.
13. Fungia.
14. Cyclolites.
15. Turbinolia.
16. Caryophyllia.
17. Sarcinula.
18. Stylina.

Order 6.—*Foraminata, Lamarck.*

In the zoophytes of this group the tubular perforations or cells for lodging the polypi are not formed by delicate radiating lamellæ, as in the preceding order. They have a compact calcareous axis, sometimes beautifully coloured, and the polypi have a complicated structure. The greater number of the zoophytes of this order are fossil. The genera are,

1. Tubipora.
2. Catenipora.
3. Favosites.
4. Millepora.
5. Distichopora.
6. Orbulites.
7. Lunulites.
8. Ovulites.

Order 7.—*Reteformia, Lamarck.*

The axis of the zoophytes, belonging to this group, is composed of delicate calcareous expansions generally cellular or reticulated, and never forms compact masses as in some of the preceding orders. The surface is composed of minute shallow cells, arranged for the most part in regular series, for the lodgment of the polypi, and for the formation of the gemmules. The polypi have generally very numerous tentacula furnished with vibratory cilia. The polypi and gemmules appear, from observations made on several species of the Frith of Forth, to succeed each other alternately in the same cells, and in those which have been examined the gemmules are irritable, and have cilia on their surface, by which they move freely to and fro after their separation. The calcareous zoophytes most common in our northern latitudes belong to this order. The genera are,

1. Dactylopora.
2. Ocellaria.
3. Alveolites.
4. Retepora.
5. Adeona.
6. Eschara.
7. Cellepora.
8. Discopora.
9. Tubulipora.
10. Flustra.

Order 8.—*Vaginiformia, Lamarck.*

The zoophytes of this order have seldom a calcareous axis. The axis, composed generally of a horny substance, forms tubular cells or sheaths for containing the polypi. They are fixed animals, generally ramified, and the horny axis is placed on the surface. The tentacula of the polypi are very numerous, and are generally furnished with vibratory cilia. This order comprehends almost all the flexible horny zoophytes, so numerous in species in every sea, and so much distinguished for their delicate plant-like ramifications. They have generally also a ramified base like a root. The gemmules are produced in vesicles which extend from the surface, and which fall off when the gemmules have escaped. The gemmules are at first connected by filaments like umbilical cords, with the fleshy matter contained within the horny axis. The genera of this order are,

1. Polyphysa.
2. Acetabulum.
3. Tibiana.
4. Dichotomaria.
5. Anguinaria.
6. Cellaria.
7. Liriozoa.
8. Serialaria.
9. Plumularia.
10. Antennularia.
11. Sertularia.
12. Campanularia.
13. Cornularia.
14. Tubularia.

Order 9.—*Lacustria.*

This order comprehends a few fresh water genera grouped together more by their abode than their organization. Three of the genera are fixed zoophytes, and the other two move freely to and fro. They are found encrusting stones and other objects on the margin of fresh water lakes. They form irregular masses perforated on the surface by the cells of the polypi, or by canals which traverse their whole interior. The polypi have an incomplete circle of tentacula around the mouth. In the Spongilla there are pores and internal canals without polypi. The genera of this order are,

1. Plumatella.
2. Alcyonella.
3. Spongilla.
4. Cristatella.
5. Difflugia.

Order 10.—*Denudata, Lamarck.*

Lamarck has comprehended under this name the four genera, Zoantha, Pedicellaria, Coryna, and Hydra. The first of these belongs to the Radiata. The second appears to be merely organs of the Echini on which it is always found. The other two genera are distinguished by being naked, soft, fleshy zoophytes, without any distinct axis. The tentacula in these genera are not furnished with vibratory cilia. They present an external gemmiparous mode of generation. The Hydræ are all fresh water animals, and the Corynæ are found only in the sea. Genera.

1. Coryna.
2. Hydra.

Order 11.—*Ciliata, Lamarck.*

This order comprehends the minutest and simplest animals of the whole class. From their smallness, and their body being generally free, they were classed among the Infusoria by former naturalists. Their body is naked, soft, transparent, and without any distinct internal axis or skeleton. There are no tentacula around the mouths of the polypi, but the margin of the oral disk is surrounded with vibratory cilia. Some of these animals are beautifully ramified, and all the ramifications are composed of the same gelatinous contractile substance as the polypi. They are called Ciliata by Lamarck, from the cilia supplying in them the place of the tentacula of the other orders. The genera of this order are

1. Tubicolaria.
2. Norticella.
3. Urceolaria.
4. Furcularia.
5. Brachionus.
6. Folliculina.
7. Vaginicola.
8. Trichocerca.
9. Rattulus.

CLASS IV.—Infusoria, *Lam.* (*Agastrica Latr*).

The class of Infusory animalcules, as now defined by Lamarck, is limited to those microscopic, transparent, gelatinous, aquatic animals, of a simple structure and form, which are destitute of an internal digestive sac or stomach, and are nourished by superficial absorption. They are found only in fluids. They present no trace of an osseous, muscular, nervous, or vascular system, nor any distinct internal organs for respiration, secretion, or generation. They generate either by a simple division of their body, or exhibit a gemmiparous mode of generation. The minutest animalcules discoverable by the aid of the microscope appear only as transparent moving points, or extremely minute gelatinous globules, without any perceptible external or internal parts. Some present a coloured and somewhat opaque point in their centre, others are distinctly observed to move by the vibration of very minute cilia variously disposed on their surface. In many animalcules we perceive a distinct internal cavity, which contains, not food, but the young, in form of minute globular gemmules, as in the Volvox and Enchelis. The body of the parent sometimes bursts to allow the escape of the young, and these species thus perish, like most insects, after a first generation. Many Infusoria have distinct external appendices, generally in form of a single or of a bifurcated tail. Some present circles of vibratory cilia on the anterior extremity of the body which, when in motion, appear like rotating wheels. The simplest animalcules, as the monads, give origin to new individuals, by their bodies gradually dividing either transversely or longitudinally, a mode of generation which is termed fissiparous. This fissiparous mode of generation is compatible only with the simplest kind of internal organization, and accords with direct observation in proving their almost homogeneous internal structure. Blumenbach, and many other naturalists, have been led by numerous experiments to believe that some kinds of animalcules may originate from mere combinations of the elements of vegetable or animal matter in a fluid state, without the aid of a previously existing parent. They have no distinction of sex, nor organs of generation. The spermatic animalcules which abound in the seminal fluid of all classes of the higher animals, form a connecting link between this class and the simplest Entozoa. Animalcules abound in decayed infusions of vegetable or animal matter, in decayed vinegar, in the secreted fluids of animals in the living state, in all stagnant waters, and in the waters of lakes and rivers. They are the food of zoophytes. We have found them in incalculable myriads in the water of harbours, and along our coasts, and at many miles distance from land among the Western Islands, and they probably abound not only in the waters of tropical seas, but in every drop of the ocean. They possess great tenacity of life. They suffer exposure to very high and very low temperatures without perishing. They may be dried to hardness, and again resuscitated by the application of moisture. According to the experiments of Baker, Needham, and others, they may be revived by moisture, after remaining many years in a dried and apparently lifeless state. They form by far the most numerous class of beings with which we are acquainted, although, from the difficulty of examining their structure and economy, they have least engaged the attention of naturalists.

These animals were discovered by Lewenhoek, who has described and figured many of the species. Muller has greatly extended our acquaintance with this class by his numerous, accurate, and full descriptions, and elegant coloured delineations of infusoria. The labours of Bruguiere in the *Encyclop. Method.* form also a valuable contribution. Baker, Needham, Ledermuller, Roesel, Buffon, Schrank, Baron Gleichen, Spallanzani, Lamarck, Bory de St. Vincent, Prevost, and Dumas, have added greatly to our knowledge of the Infusoria by their interesting observations on the economy of the species, or by their general views of their classification. They are called *Agastrica* by Latreille, from their having no internal stomach; *Protozoa* by Meckel, from their being in all probability the first formed of animals; *Microscopica* by Bory St. Vincent, from their minuteness. This class has been divided by most writers into three distinct groups, which may be considered as orders, though still founded on unimportant characters, viz. Appendiculata, Membranacea, and Incrassata.

Order 1.—*Appendiculata.*

This order comprehends the most highly organized species belonging to this class, some of which make a near approach to the simplest of the ciliated zoophytes. They present distinct projecting parts, variously situated on the surface of the body, sometimes extending from the anterior part like tentacula or like feet, and sometimes from the posterior extremity like a simple or a bifurcated tail. These animalcules sometimes multiply with great rapidity in our fresh water stagnant pools, giving a lively green, red, brown, or other colour to the surface. We have observed the *Furcularia viridis*, Lam. which often forms a lively green-coloured film on the surface of our stagnant ponds, to be affected by light precisely in the same manner as the Hydra among zoophytes. They seek always the illuminated side of the vessel or of the pond in which they are observed. Lamarck comprehends under this order the Genera,

1. Furcocerca.
2. Cercaria.
3. Kerona.
4. Trichoda.

Order 2. *Membranacea.*

The animalcules of this order have a simpler form and structure than the preceding. They have generally a depressed or flattened body, with an ovoidal or circular form. They have not those projecting parts like members seen in the former order. The body is sometimes long, slender and flattened like a membrane, as in some of the Kolpodæ, in others it is nearly circular, as in the Cyclidium, in others irregularly ovoidal, as in the Paramæcium, and in others angular, as in the Gonium. In the Bursaria, the absorbing surface of the animalcules is increased by the body being concave or hollow like a purse, which probably also affords a safer position for the development of the reproductive gemmules. This order is composed of the genera,

1. Bursaria.
2. Kolpoda.
3. Paramæcium.
4. Cyclidium.
5. Gonium.

Order 3. *Incrassata.*

This order comprehends the smallest and simplest animalcules hitherto discovered by the aid of the microscope. They have neither the external appendices of the first order, nor the flattened membranous form of the second, but have generally a spherical, oblong, or cylindrical body. They are termed Incrassata from the thickness of the body compared with its other dimensions. In some the body has a regular spherical form, as in some Monades and Volvoces; some of the Enchilides have the body pear-shaped or fusiform, and in many of the Vibriones it is of a lengthened cylindrical serpentine form. The genera of this order are

1. Vibrio.
2. Enchilis.
3. Proteus.
4. Volvox.
5. Monas.

ZUINGLE, Ulric, a celebrated Swiss reformer, was born on January 1, 1484, at Wildhausen, and fell in the battle at Cappel between the Catholic and Protestant cantons in October 1531, in the 47th year of his age. See our article Ecclesiastical History.

ZURICH, Canton of. See Switzerland.

ZURICH, a city of Switzerland, and capital of a canton of the same name, is beautifully situated on the lake of Zurich, where the river Limmat discharges itself. This river, which divides the city into two parts, is crossed by three bridges. It may also be crossed at the flour-mills, which are built in the middle of this river. The principal public buildings are the cathedral, the Maison des Orphelins, the Meiser, the Maison de Ville, the Helmshouse which contains the library, the Cassino, and the churches of Notre Dame and St. Pierre.

The cathedral is a large Gothic building, but destitute of those beauties which belong to that style of architecture. It consists of a body and two square towers 262 feet it height, placed at the southern extremity of the church. The towers are square, and built of stone for about two-thirds of their height. The rest, which is polygonal and terminating in a pointed dome, is built of wood and is covered with copper on the outside. The seats in the cathedral turn up, and each has arms like an arm-chair. It contains two churches. The cathedral has a good library.

The Maison des Orphelins, situated on the south-west side of the river upon its banks, is a very neat building, having its principal and its back front of the same form. It is ornamented with six Ionic pilasters and a pediment. It has 13 windows in front and five windows in a line on the side, and is three stories high.

The Meiser is a very neat public building on the south-east side of the river, and at the end of the High Bridge. It has six Ionic columns in front, and is three stories high. There are eleven windows in a line in front, and seven in a line in the side. The centre windows both at the front and side have a large balcony of stone. Above each window is a sculptured ornament. Above the centre of the building is a semicircular pediment with a triangular pediment on each side of it. The cabinet Physiognomique is contained in this building.

The Maison de Ville is an elegant building, begun in 1794. It is built upon the river (which runs below it), at the north-east extremity of the low wooden bridge. It is a mixture of Greek and Gothic, and is three stories high. The first storey has Tuscan pilasters, the second Ionic, and the third Corinthian. There are nine windows in a line in front and three in depth, each window having above it a semicircular and a tringular pediment alternately. Above the windows of the first storey all around there are placed within the pediments statues of eminent men. The list commences with Junius Brutus, Cocles, Scævola, all the rest being chiefly Swiss. The name of the person is engraven on the stone, and an appropriate Latin motto is carved beneath each. The principal door is of black marble, with a gilt lion above each column. In the lobby are two pictures containing representations of all the fish found in the lake, to the number of 30.

The Helmhouse is built a little farther up the river on the same side, and at the north-east extremity of the Haut Pont. It is a good building, with arcades and shops below, and contains the public library above. There are five arcades fronting down the river, and three across it, and the water runs below it. The library is three stories high, and is like a church within, with two galleries supported by columns. It contains besides the books two large globes, a bronze bust of Heidegger upon a marble pyramid, and several Roman monuments, some of which were found at Kloffen. In the apartments above is a small collection of minerals, and in one apartment is a marble bust of Lavater and one of Gesner, and an alto-relievo of Bodmer, with some other busts of eminent men, and paintings of many of the burgomasters.

The Cassino is a very neat building of one storey, with a portal and six fluted Tuscan columns.

The church of Notre Dame has a neat spire, but is in no other respect deserving of notice. The church of St. Pierre has a square tower and pyramid, and contains besides the pulpit a monumental inscription in honour of Lavater.

There is a small green island at the mouth of the lake, belonging to the town; and a little below it, a prison, rising out of the water, and which is used for confining criminals condemned to death.

Below the lower bridge, there are a number of warehouses, built in the very middle of the river; and farther down are the mills for grinding corn, already mentioned. From these mills to the south-west bank, there is a wooden bridge, through which the water rushes with great velocity. In the middle of both the upper and the lower bridges, a wheel is placed, for the purpose of raising water.

There are at Zurich twenty schools and literary establishments. The chief of these are the Collegium Carolinum, a military and a medical seminary, with two schools. Philosophy, divinity, and classics are taught in the college. A society of physics, œconomics, and natural history has been established. Cotton works to a considerable extent have been established.

The new promenade on the north-east side of the town is very elegant, with a bosquet at its farther extremity, from which there is a fine view of the lake, whose banks are covered with villages and country houses. On the south side the ground is gently undulating, and behind it is a high wooden ridge. From the north side the banks rise into a fine height, and are covered with numerous vineyards, while the snowy Alps rise majestically in the distance.

The view of the town and the lake from this spot is truly enchanting.

The promenade of Lindenhoff is ornamented with large trees, and furnished with seats on an elevated spot on the south bank of the river, a little below the lower bridge.

The principal promenade, however, extends from the Maison des Orphelins, along the banks of the Limmat, to its junction with the Sihl, and then turns up the right bank of the latter river. A fine monument is erected here to the memory of Solomon Gesner. It consists of a square pyramid of marble, surmounted with a white marble urn; on one side is a bronze bust of him, and the date of his birth and death, and on the other is a long German inscription. At the south-east end of the promenade is the *tirage*, or place for shooting, with a number of small houses for that purpose.

The walks which surround Zurich are very handsome, and the fine green mounds along their summits are extremely beautiful. A stream from the lake runs around them on the south, and joins the Limmat on the Sihl. The canal enters the river at the mill.

The lake of Zurich is about thirty miles long, and is divided into the upper and lower lake by the strait of Rapperschwyl, where it is crossed by a wooden bridge a little more than a quarter of a mile long. The greatest breadth of the lake is about five miles. The upper lake freezes in winter, but the lower lake is frozen only in severe seasons. The scenery on its banks is remarkably beautiful.

The inhabitants, who are almost all Calvinists, amount to about 11,000. East Long. 8° 31′ 30′. North Lat. 47° 22′ 33″.

ZURICH MACHINE. See HYDRODYNAMICS.

GENERAL EXPLANATION

OF THE

PLATES BELONGING TO VOLUME EIGHTEENTH

OF THE

AMERICAN EDITION

OF THE

NEW EDINBURGH ENCYCLOPÆDIA.

PLATE DXXIV.

Fig. 1. Represents the Air Thermometer of Sanctorius and Drebbel.
Fig. 2. Boyle's improvement upon it.
Fig. 3. Referred to by mistake.
Fig. 4. Mercurial Thermometer.
Fig, 5, 6. Breguet's Metallic Thermometer.
Fig. 7. Breguet's Spiral Thermometer.
Fig. 8—11. Show the method of blowing the bulbs of Thermometers.
Fig. 12. Represents the Rev. Mr Wollaston's Thermometrical Barometer.
Fig 13. Lord Charles Cavendish's Self-Registering Thermometer for the maximum temperature.
Fig. 14. His instrument for the minimum temperature.
Fig. 15. Mr. Forbes's maximum and minimum Self-resistering Thermometer.
Fig. 16. Six's Self-registering Thermometer.

PLATE DXXV.

Fig. 1, 2. Dr. Rutherford's Self-registering Thermometer.
Fig. 3. Dr. Traill's Self-registering Thermometer.
Fig. 4. Mr. Keith of Ravelstone's Registering Thermometer.
Fig. 5, 6. Mr. Blackadder's Registering Thermometer.
Fig. 7, 8. Show the Differential Thermometer of Sturmius revived by Rumford and Leslie.
Fig. 9. Is Baron Fourier's Thermometer of Contact.
Fig. 10. Represents Kewley's balance Thermometer.
Fig. 11. Represents the Horary Thermometric curve of 1824 and 1825, as deduced by Dr. Brewster from the Leith hourly Observations.

PLATE DXXVI.

Fig. 1, 2. Contain an Isometrical view of the Planing Engine.
Fig. 1-5. Represent the Tunnel across the Thames, and Mr. Brunel's method of excavating it.

PLATE DXXVII.

Fig. 1-7. Contain an Isometrical view of a Slide Rest, Turning Lathe and apparatus.

PLATE DXXVIII.

Fig. 1. Represents the magnetic curves of equal intensity in the Northern Hemisphere, according to the observations of Hansteen and Sabine.
Fig. 2. Is Colonel Beaufoy's Variation instrument.

PLATE DXXIX, Fig. 1.

Fig. 1. Represents Mr. Dollond's Variation Transit.
Fig. 2. Represents Mr. Dollond's Dipping Needle.
Fig. 3, 4, 5, 6. Show Mr. Dollond's Diurnal Variation instrument.
Fig. 7. Is a sketch of Professor Hansteen's instrument for determining the Magnetic Intensity.

PLATES DXXX, DXXXI, DXXXII,

Are illustrative of the article Veterinary Medicine, and are minutely explained in pages 212, 213 of this volume.

APPENDIX

TO ARTICLE UNITED STATES.

Summary Tables of the Population of the United States, agreeably to the Census of 1830.

STATES.	MALES.												
	Under 5 years of age.	Of 5 and under 10.	Of 10 and under 15.	Of 15 and under 20.	Of 20 and under 30.	Of 30 and under 40.	Of 40 and under 50.	Of 50 and under 60.	Of 60 and under 70.	Of 70 and under 80.	Of 80 and under 90.	Of 90 and under 100.	Of 100 and upwards.
	34,053	28,742	25,522	22,400	34,985	21,701	14,547	9,228	5,956	2,637	823	93	2
Hampshire	19,428	17,521	16,737	14,847	21,191	14,696	10,772	7,218	5,059	2,786	840	85	4
chusetts	40,644	35,988	34,679	32,801	58,621	35,433	23,683	15,008	10,319	5,575	1,760	173	1
Island	6,733	5,786	5,400	5,354	8,425	5,379	3,512	2,157	1,444	854	261	28	
cticut	19,033	17,891	17,788	16,509	26,166	16,608	11,595	7,851	5,495	3,154	871	81	5
ont	21,700	19,406	17,597	15,782	24,207	15,773	10,405	7,051	5,203	2,203	618	48	3
. Dist. of N. York	118,540	103,372	88,558	74,040	125,086	79,831	49,689	29,278	17,199	7,047	1,753	177	19
Dist. of N. York	39,537	33,699	29,965	27,672	51,668	33,305	19,182	11,225	6,710	2,987	808	78	16
Jersey	25,071	21,204	19,745	17,123	27,001	17,231	11,043	7,053	4,458	2,021	534	44	1
n Dist. of Penn.	60,917	50,357	44,956	41,345	68,421	42,729	26,595	15,568	8,728	3,712	891	100	19
rn Dist. of Penn.	56,936	45,842	37,419	31,768	52,938	32,443	20,005	12,464	7,357	3,267	884	128	23
are	4,744	4,099	3,919	3,184	5,508	3,206	2,036	1,286	609	202	43	9	
and	23,737	19,438	17,886	15,778	29,397	18,215	11,072	6,565	3,462	1,375	355	53	7
n Dist. of Virg.	33,143	26,390	22,527	19,801	33,260	20,892	13,462	8,786	4,853	1,928	571	87	13
rn Dist. of Virg.	32,650	25,415	20,760	17,146	27,651	15,647	9,919	6,475	4,118	1,746	537	97	13
Carolina	46,749	35,950	30,527	25,452	39,428	23,042	14,998	10,536	5,968	2,489	649	138	28
Carolina	25,132	20,259	16,497	13,961	22,164	13,969	8,334	5,644	3,042	1,210	298	66	14
ia	33,027	23,709	18,584	15,186	26,844	16,156	9,542	5,674	3,083	1,120	290	63	10
. Dist. of Alaba.	9,459	6,727	5,221	4,300	7,036	4,458	2,516	1,501	773	246	63	11	
. Dist. of Alaba.	13,305	8,755	6,908	5,209	10,404	6,941	3,513	2,092	968	345	84	8	3
ssippi	7,918	5,572	4,591	3,623	7,237	4,632	2,419	1,595	632	189	47	11	
Dist. of Louisiana	5,007	4,175	3,350	2,852	7,430	5,670	3,156	1,446	633	226	61	18	8
Dist. of Louisiana	2,961	2,227	1,784	1,473	3,028	2,107	1,148	577	263	91	17	6	1
rn Dist. of Tenn.	19,612	14,726	11,790	9,581	14,085	7,765	4,733	3,727	2,002	877	291	43	11
ern Dist. of Tenn.	39,964	30,640	24,254	19,666	30,897	17,346	10,375	7,461	3,541	1,230	366	62	21
cky	54,116	41,073	34,222	29,017	45,913	26,289	15,966	10,843	6,253	2,585	699	119	28
	96,411	74,690	62,151	51,138	81,290	49,346	31,112	18,058	10,783	3,632	935	138	29
na	39,780	28,692	22,872	17,653	28,153	17,904	10,306	6,004	3,160	1,059	240	49	13
is	18,834	12,753	10,024	7,770	14,706	8,825	4,627	2,853	1,172	384	90	6	4
ouri	13,531	9,617	7,469	5,639	11,147	7,084	3,642	1,939	927	334	60	14	2
ERRITORIES.													
igan	3,023	2,326	1,905	1,543	4,389	2,739	1,232	658	264	64	20	4	1
nsas	3,020	2,021	1,626	1,272	2,835	1,820	876	434	209	69	12	1	
Dist. of Florida	441	326	261	170	475	428	190	96	49	22	5		
. Dist. of Florida	550	355	273	245	664	489	218	157	72	15	1	1	1
. Dist. of Florida	18	12	14	18	80	72	39	18	5				
le Dist. of Florida	923	640	467	356	952	547	313	165	68	20	4	1	
ict of Columbia	2,333	1,680	1,486	1,522	2,805	1,817	1,068	593	245	71	25	1	1
of the U. States	972,980	782,075	669,734	573,196	956,487	592,535	367,840	229,284	135,082	57,772	15,806	2,041	301

STATES.	FEMALES.											
	Under 5 years of age.	Of 5 and under 10.	Of 10 and under 15.	Of 15 and under 20.	Of 20 and under 30.	Of 30 and under 40.	Of 40 and under 50.	Of 50 and under 60.	Of 60 and under 70.	Of 70 and under 80.	Of 80 and under 90.	Of 90 and under 100.
Maine	32,471	27,676	24,067	22,348	35,596	22,259	14,183	9,330	5,904	2,688	911	138
New Hampshire	18,538	16,790	15,525	14,823	24,564	16,690	11,896	8,448	5,888	3,110	1,085	174
Massachusetts	39,533	34,537	33,326	34,439	60,495	38,163	26,684	18,456	12,989	7,173	2,528	347
Rhode Island	6,623	5,642	5,213	5,584	9,203	5,756	4,024	2,826	1,939	1,058	376	44
Connecticut	18,270	16,943	16,575	15,978	26,540	17,937	13,214	9,245	6,707	3,760	1,228	156
Vermont	21,334	18,632	16,870	15,753	25,180	16,264	11,034	7,152	4,727	2,086	652	87
North. Dist. of N. York	113,807	100,147	85,608	75,001	117,190	72,696	45,213	26,682	15,451	6,356	1,713	201
South. Dist. of N. York	38,061	32,937	29,558	30,195	51,707	31,826	19,102	11,662	7,138	3,289	960	103
New Jersey	23,937	20,479	18,267	16,784	25,817	16,623	11,007	7,307	4,705	2,160	586	63
Eastern Dist. of Penn.	58,038	48,411	43,612	43,598	67,050	40,870	26,277	16,623	9,780	4,287	1,147	130
Western Dist. of Penn.	53,909	44,308	36,475	32,378	48,848	28,734	18,203	11,259	6,441	2,797	782	105
Delaware	4,647	4,011	3,654	3,381	5,484	3,179	2,047	1,397	630	263	56	6
Maryland	22,356	18,693	17,327	18,020	27,248	16,617	10,840	6,983	3,633	1,541	432	64
Eastern Dist. of Virg.	31,391	25,373	22,361	22,438	35,287	21,483	14,049	9,303	5,193	2,295	622	133
Western Dist. of Virg.	31,020	24,591	19,575	18,041	26,757	14,973	9,701	6,144	3,572	1,552	476	55
North Carolina	43,775	34,264	28,842	27,398	41,636	24,534	16,428	10,601	5,980	2,496	747	158
South Carolina	23,691	19,043	15,632	15,122	21,866	13,438	8,468	5,455	2,929	1,181	351	80
Georgia	30,958	22,590	17,988	16,452	24,036	13,974	8,427	5,089	2,664	987	268	65
North. Dist. of Alaba.	8,964	6,426	4,927	4,404	6,306	3,665	2,135	1,186	575	182	69	16
South. Dist. of Alaba.	12,376	8,375	6,165	5,547	8,151	4,894	2,560	1,545	744	250	75	13
Mississippi	7,319	5,165	4,169	3,653	5,231	3,090	1,739	983	436	149	34	7
East. Dist. of Louisiana	5,000	4,045	3,407	3,151	4,693	2,929	1,603	848	497	173	60	13
West. Dist. of Louisiana	2,800	2,148	1,733	1,558	2,237	1,275	707	409	163	49	13	4
Eastern Dist. of Tenn.	18,114	14,019	11,045	10,086	14,746	7,945	5,138	3,335	1,773	739	225	48
Western Dist. of Tenn.	37,285	28,956	22,511	20,530	28,224	15,600	10,126	5,944	2,768	1,116	317	62
Kentucky	50,835	39,439	32,197	29,623	41,936	23,463	15,476	9,499	5,315	2,195	575	97
Ohio	89,873	71,851	59,306	52,635	75,574	43,894	27,546	15,898	8,293	2,915	736	89
Indiana	37,505	27,313	21,072	18,087	26,702	15,703	9,028	4,808	2,275	780	212	25
Illinois	17,429	12,000	9,246	8,053	12,461	6,850	3,750	2,047	812	273	77	14
Missouri	12,561	9,077	6,794	5,765	8,791	5,121	2,718	1,499	766	227	60	9
TERRITORIES.												
Michigan	2,743	2,066	1,686	1,438	2,540	1,399	726	390	140	35	10	5
Arkansas	2,782	1,897	1,494	1,225	2,012	1,087	528	301	107	31	9	3
East. Dist. of Florida	432	290	266	229	360	215	143	60	36	16	3	2
West. Dist. of Florida	502	352	262	276	398	231	139	83	24	15	4	2
South. Dist. of Florida	15	9	12	11	24	11	4	4	1		1	
Middle Dist. of Florida	858	600	441	407	665	391	198	100	40	14	2	1
District of Columbia	2,182	1,646	1,648	1,843	2,856	1,752	980	603	272	98	32	4
Total of the U. States	921,934	750,741	638,856	596,254	918,411	555,531	356,046	223,504	131,307	58,336	17,434	2,523

STATES.	SLAVES.											
	MALES.						FEMALES.					
	Under 10 years of age.	Of 10 and under 24.	Of 24 and under 36.	Of 36 and under 55.	Of 55 and under 100.	Of 100 and upwards.	Under 10 years of age.	Of 10 and under 24.	Of 24 and under 36.	Of 36 and under 55.	Of 55 and under 100.	Of 100 and upwards.
Maine									1		1	
New Hampshire									2	1		
Massachusetts												1
Rhode Island		2			1			4	1	1	8	
Connecticut	1	2		1	4		1	3		4	9	
Vermont												
North. Dist. of N. York	5	6		1		1	12	10	12	1	5	1
South. Dist. of N. York							11	2	5	2	1	
New Jersey	5	12	395	383	261	3	8	20	424	451	288	4
Eastern Dist. of Penn.	7	43	19	3	9	1	12	62	17	14	30	4
Western Dist. ôf Penn.*	16	59	6	8	1		20	44	5	11	12	
Delaware	580	853	245	83	42	3	508	617	230	80	49	2
Maryland	17,880	17,759	8,846	6,135	2,772	50	17,002	16,236	8,331	5,329	2,601	53
Eastern Dist. of Virg.	74,158	60,074	38,403	27,696	11,121	125	73,666	58,574	36,670	24,483	11,219	131
Western Dist. of Virg.	9,842	8,843	4,786	2,987	1,034	8	9,541	8,347	4,257	2,723	1,056	13
North Carolina	45,991	38,099	20,212	14,030	5,848	133	44,847	37,508	20,095	13,088	5,636	114
South Carolina	51,820	44,600	29,710	21,674	7,567	98	51,524	45,517	32,689	22,006	8,112	84
Georgia	38,367	34,253	19,440	12,818	3,847	92	38,102	33,917	20,527	12,325	3,765	78
North. Dist. of Alaba.	8,252	7,318	4,247	1,957	604	5	7,974	7,152	4,209	1,897	507	8
South. Dist. of Alaba.	13,585	12,235	6,853	3,201	891	22	13,412	12,517	6,879	3,001	805	18
Mississippi	11,037	10,793	6,947	3,455	845	22	10,860	10,841	6,983	3,173	682	21
East. Dist. of Louisiana	9,354	12,990	12,199	6,416	1,660	29	9,534	12,156	10,244	4,587	1,245	31
West. Dist. of Louisiana	4,273	4,936	3,585	2,027	429	13	4,153	4,457	3,290	1,662	307	11
Eastern Dist. of Tenn.	3,404	3,092	1,281	713	245	6	3,271	3,164	1,474	903	325	9
Western Dist. of Tenn.	24,309	20,339	9,979	5,307	1,484	57	23,297	20,981	10,749	5,616	1,566	32
Kentucky	31,500	27,449	13,520	7,499	2,280	61	30,975	27,346	13,854	8,107	2,572	50
Ohio		1						2	3			
Indiana								2		1		
Illinois	98	118	76	47	6	2	144	128	61	52	12	3
Missouri	4,872	4,364	2,058	923	208	14	4,611	4,605	2,199	1,014	219	4
TERRITORIES.												
Michigan	2	7	11	1	1		1	3	3	3		
Arkansas	845	814	395	192	47		803	836	399	193	51	1
East. Dist. of Florida	627	588	461	289	93		695	571	471	233	67	
West. Dist. of Florida	566	602	496	231	52		597	605	382	185	36	1
South. Dist. of Florida	7	17	11	5	2		3	7	10	4		
Middle Dist. of Florida	1,301	1,275	862	423	77		1,265	1,266	698	346	74	
District of Columbia	794	1,024	542	375	114	3	816	1,270	612	391	176	2
Total of the U. States	353,498	312,567	185,585	118,880	41,545	748	347,665	308,770	185,786	111,887	41,436	676

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* It appears by the census of 1830, that the state of Pennsylvania contains 403 slaves, while in 1820, according to the census of that year, the whole number was only 211; thus exhibiting an increase of 192 in the interval of ten years. This, however, is manifestly an error, because by an act passed by the legislature of Pennsylvania on the first day of March 1780, slavery was forever abolished in relation to children born in the state after that period, (although the children born of slaves might be held to service till they arrived at the age of 28 years); hence, it is obvious that the number of slaves in this state cannot possibly increase; and equally so, that in 1830 the youngest slave in the state must have been above 50 years of age; but by an examination of the returns as exhibited in the above Table, the reader will perceive that, of the number of slaves returned, 310 are stated as under 36 years; deducting these from 403, the whole number reported, the number of slaves in Pennsylvania would be reduced to 93: but by the same table it appears that of these 93, thirty-six are

STATES.	FREE COLOURED PERSONS.												
	MALES.						FEMALES.						
	Under 10 years of age.	Of 10 and under 24.	Of 24 and under 36.	Of 36 and under 55.	Of 55 and under 100.	Of 100 and upwards.	Under 10 years of age.	Of 10 and under 24.	Of 24 and under 36.	Of 36 and under 55.	Of 55 and under 100.	Of 100 and upwards.	Total population.
Maine	163	172	111	108	54	2	143	175	117	93	52		399,455
New Hampshire	67	78	53	44	32	1	68	97	54	63	45	2	269,328
Massachusetts	806	887	718	629	314	4	812	967	815	661	396	39	610,408
Rhode Island	337	501	317	238	152	3	355	597	443	350	265	3	97,199
Connecticut	1,019	1,121	771	624	313	2	1,051	1,233	819	667	417	10	297,675
Vermont	121	116	78	60	48	3	121	131	73	71	57	2	280,652
North. Dist. of N. York	1,514	1,640	1,186	806	357	10	1,526	1,867	1,192	814	406	13	1,366,052
South. Dist. of N. York	4,129	4,454	3,674	2,686	1,001	9	3,983	4,976	4,312	2,966	1,308	41	546,954
New Jersey	3,033	3,234	1,458	1,196	573	7	2,811	2,890	1,428	1,113	554	6	320,823
Eastern Dist. of Penn.	4,016	4,209	3,409	2,317	921	29	4,003	5,091	3,873	2,299	927	26	755,514
Western Dist. of Penn.	1,079	1,041	660	479	211	6	1,051	1,051	603	443	178	8	592,719
Delaware	2,627	2,259	1,303	1,180	505	10	2,524	2,359	1,446	1,102	526	16	76,748
Maryland	8,309	6,099	4,020	4,142	2,287	49	7,912	7,313	5,389	4,535	2,796	87	447,040
Eastern Dist. of Virg.	7,118	5,240	3,047	2,302	1,472	24	6,891	6,172	3,960	2,973	1,783	23	832,980
Western Dist. of Virg.	1,118	886	499	419	259	3	1,111	859	541	406	241	1	378,425
North Carolina	3,438	2,955	1,400	1,062	685	21	3,287	3,118	1,649	1,179	720	29	737,987
South Carolina	1,314	958	622	424	335	19	1,378	1,175	746	545	399	6	581,185
Georgia	368	353	224	186	118	12	347	330	231	185	126	6	516,823
North. Dist. of Alaba.	75	54	66	39	19		54	48	31	19	16	1	125,725
South. Dist. of Alaba.	200	148	121	85	37		191	161	100	65	40	2	183,802
Mississippi	81	82	59	43	22	1	72	51	45	49	14		136,621
East. Dist. of Louisiana	2,077	1,949	1,000	683	302	9	2,212	2,391	1,720	1,268	657	25	155,189
West. Dist. of Louisiana	426	347	208	145	82	2	428	336	207	134	98	4	60,340
Eastern Dist. of Tenn.	358	257	129	125	91	1	352	270	168	112	80	1	196,301
Western Dist. of Tenn.	484	326	232	196	125	6	420	346	191	173	107	5	485,603
Kentucky	764	584	410	484	402	8	633	505	351	398	369	9	687,917
Ohio	1,562	1,440	808	646	325	8	1,573	1,551	799	611	241	4	937,903
Indiana	617	544	307	240	138	11	594	573	279	215	107	4	343,031
Illinois	277	251	136	119	40	1	305	225	125	106	50	2	157,445
Missouri	87	76	43	57	18	3	77	62	46	63	34	3	140,455
TERRITORIES.													
Michigan	31	43	48	29	8		20	36	26	16	4		31,639
Arkansas	27	17	23	17	3	1	17	13	10	7	6		30,388
East. Dist. of Florida	55	40	13	24	20	1	59	53	37	21	23		8,956
West. Dist. of Florida	66	55	25	25	10		71	65	23	34	21	1	9,478
South. Dist. of Florida	11	13	6	6	2		12	16	7	6	4		517
Middle Dist. of Florida	6	1	2	1	1		2	2	3	1			15,779
District of Columbia	895	649	464	405	229	3	863	1,033	682	564	358	7	39,834
Total of the U. States	48,675	43,079	27,650	22,271	11,509	269	47,329	48,138	32,541	24,327	13,425	386	12,854,890

in the class between the ages of 36 and 55 years, and it is impossible to believe that these are all above the age of 50 years, which, as we have already shown, is the minimum age of a slave in Pennsylvania. On the contrary, it is much more probable, that they are nearly all below the age of 50, and therefore ought also to be deducted. But as this cannot be ascertained with precision, we deem it a fair estimate to suppose that the 36 are equally distributed through the interval of 19 years, being the period between the ages of 36 and 55, making the average number for each year $1\frac{17}{19}$, and for the first 14 years of the interval, or between the ages of 36 and 50 years, $26\frac{10}{19}$ or nearly 27 persons. These 27 being too young to be slaves, must be deducted from the 93 above mentioned, and there will be only 66 remaining as the total number of slaves in Pennsylvania.—J. PARKER.

STATES.	WHITE PERSONS, Included in the foregoing.					SLAVES AND COL'D, Included in the foregoing.			
	Who are deaf and dumb, under 14 years of age.	Who are deaf and dumb, of the age of 14 and under 25.	Who are deaf and dumb, of 25 and upwards.	Who are blind.	ALIENS — Foreigners not naturalized.	Who are deaf and dumb, under 14 years of age.	Who are deaf and dumb, of the age of 14 and under 25.	Who are deaf and dumb of the age of 25 and upwards.	Who are blind.
Maine	64	60	56	159	3,526	4		1	1
New Hampshire	32	55	48	105	410	5	1	3	
Massachusetts	56	62	138	218	8,787	2	3	4	5
Rhode Island	6	22	28	56	1,100	2	2		8
Connecticut	43	152	99	188	1,481	4	2		7
Vermont	39	59	55	51	3,364	3		2	
North. Dist. of N. York	201	198	197	453	29,631	9	6	6	13
South. Dist. of N. York	76	112	58	189	22,857	8	8	6	69
New Jersey	64	71	72	205	3,365	5	2	8	22
Eastern Dist. of Penn.	119	153	152	250	8,941	8	8	12	18
Western Dist. of Penn.	105	126	103	225	6,435	4	4	3	10
Delaware	6	15	14	18	313		5	4	11
Maryland	50	31	54	147	4,786	40	30	26	124
Eastern Dist. of Virg.	70	64	93	215	363	40	34	32	393
Western Dist. of Virg.	62	54	76	140	426	11	7	6	45
North Carolina	70	81	79	223	202	31	27	25	161
South Carolina	60	52	62	102	486	9	27	33	136
Georgia	50	51	44	150	101	26	21	12	123
North. Dist. of Alaba.	11	12	8	30	20	4	4	2	12
South. Dist. of Alaba.	34	13	11	38	45	5	3	5	36
Mississippi	12	10	7	25	72	2	8	2	31
East. Dist. of Louisiana	9	8	11	29	1,610	5	4	8	62
West. Dist. of Louisiana	6	7	8	7	103	2	1	1	15
Eastern Dist. of Tenn.	18	21	17	89	56	3	1		13
Western Dist. of Tenn.	41	38	37	87	63	10	8	6	24
Kentucky	100	113	90	169	173	16	25	5	83
Ohio	148	160	118	232	5,778	5		4	6
Indiana	49	59	33	85	279	1	2		2
Illinois	23	27	16	35	451				4
Missouri	12	5	10	27	155	2	1	5	10
TERRITORIES.									
Michigan	4	7	4	5	1,497				
Arkansas	6	2	2	8	11	4			2
East. Dist. of Florida	1		1		8			1	8
West. Dist. of Florida	1		2	2	106	1	1	1	6
South. Dist. of Florida					96				
Middle Dist. of Florida				1	11		1	1	2
District of Columbia	4	5	3	11	724	2			8
Total of the U. States	1,652	1,905	1,806	3,974	107,832	273	246	224	1,470

Recapitulation of the Population of the United States, by Classes and Ages.

WHITES.

MALES under five years of age,	972,980
of five and under ten,	782,075
of ten and under fifteen,	669,734
of fifteen and under twenty,	573,196
of twenty and under thirty,	956,487
of thirty and under forty,	592,535
of forty and under fifty,	367,840
of fifty and under sixty,	229,284
of sixty and under seventy,	135,082
of seventy and under eighty,	57,772
of eighty and under ninety,	15,806
of ninety and under one hundred,	2,041
of one hundred and upwards,	301
	5,355,133
FEMALES under five years of age,	921,934
of five and under ten,	750,741
of ten and under fifteen,	638,856
of fifteen and under twenty,	596,254
of twenty and under thirty,	918,411
of thirty and under forty,	555,531
of forty and under fifty,	356,046
of fifty and under sixty,	223,504
of sixty and under seventy,	131,307
of seventy and under eighty,	58,336
of eighty and under ninety,	17,434
of ninety and under one hundred,	2,523
of one hundred and upwards,	238
	5,171,115
Total number of free white persons,	10,526,248

SLAVES.

MALES under ten years of age,	353,498
of ten and under twenty-four,	312,567
of twenty-four and under thirty-six,	185,585
of thirty-six and under fifty-five,	118,880
of fifty-five and under one hundred,	41,545
of one hundred and upwards,	748
	1,012,823
FEMALES under ten years of age,	347,665
of ten and under twenty-four,	308,770
of twenty-four and under thirty-six,	185,786
of thirty-six and under fifty-five,	111,887
of fifty-five and under one hundred,	41,436
of one hundred and upwards,	676
	996,220
Total number of slaves,	2,009,043

FREE COLOURED PERSONS.

MALES under ten years of age,	48,675
of ten and under twenty-four,	43,079
of twenty-four and under thirty-six,	27,650
of thirty-six and under fifty-five,	22,271
of fifty-five and under one hundred,	11,509
of one hundred and upwards,	269
	153,453
FEMALES under ten years of age,	47,329
of ten and under twenty-four,	48,138
of twenty-four and under thirty-six,	32,541
of thirty-six and under fifty-five,	24,327
of fifty-five and under one hundred,	13,425
of one hundred and upwards,	386
	166,146
Total number of free coloured persons,	319,599

Summary of the whole Population of the United States.

Total number of free white persons,		10,526,248
Ditto slaves,		2,009,043
Ditto free coloured persons,		319,599
Total,		12,854,890
Add to the above total, for the Southern District of New York, being the number of Aliens, &c. in 9th ward of New York city, who were not included in the columns of ages in the return of the Marshal's assistant for that ward.	5,477	
And for the number of inmates of the Poor-house at New Peltz, Ulster county,	125	
	5,602	
For Eastern District of Louisiana as per error of the Marshal's Assistant,	210	
The whole number of persons employed on board the public ships in the service of the United States on the 1st June 1830,	5,318	
		11,130
Grand Total,		12,866,020

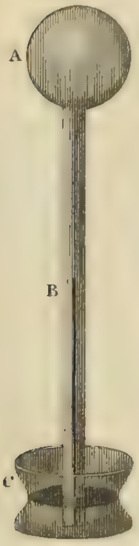
White persons	included in the foregoing	who are	deaf and dumb,	under fourteen years of age,	1,652
Do	do	do	do	of fourteen and under twenty-five	1,905
Do	do	do	do	of twenty-five and upwards,	1,806
Do	do	do	blind		3,974
Do	do	do	Aliens.	Foreigners not naturalized,	107,832

Slaves and coloured persons	included in the foregoing	who are	deaf and dumb,	under fourteen years of age,	273
Do	do	do	do	of fourteen and under twenty-five,	246
Do	do	do	do	of twenty-five and upwards,	224
Do	do	do	blind,		1,470

FINIS.

THERMOMETER PLATE DXXIV

Fig. 1.



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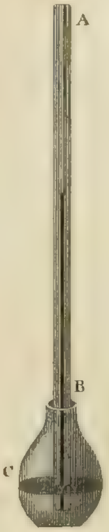


Fig. 4.

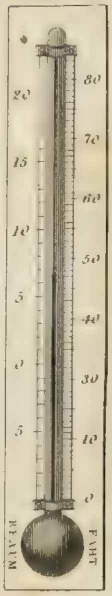


Fig. 5.

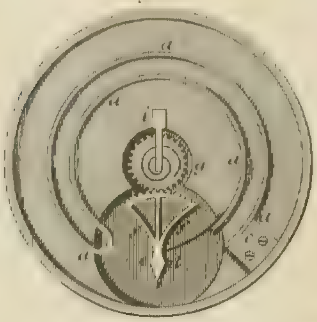


Fig. 6.

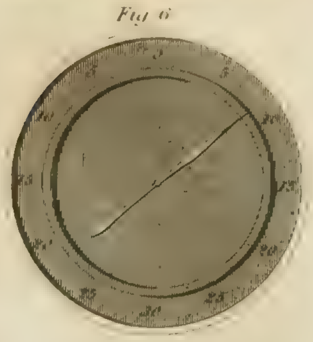


Fig. 10.

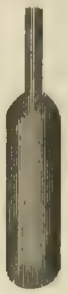


Fig. 7.

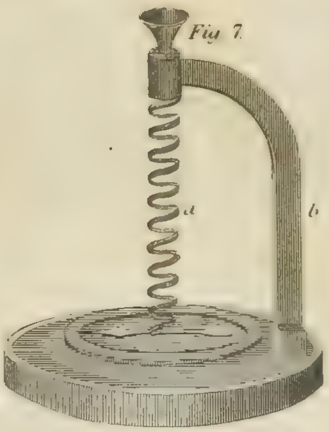
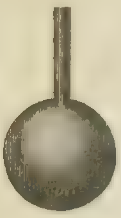


Fig. 8.



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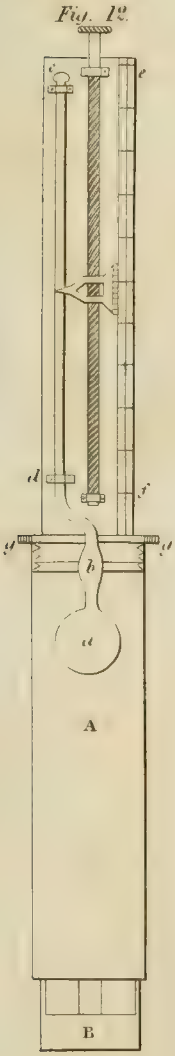


Fig. 9.

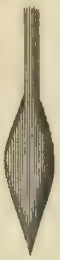
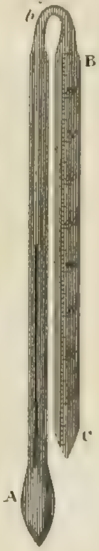


Fig. 3.



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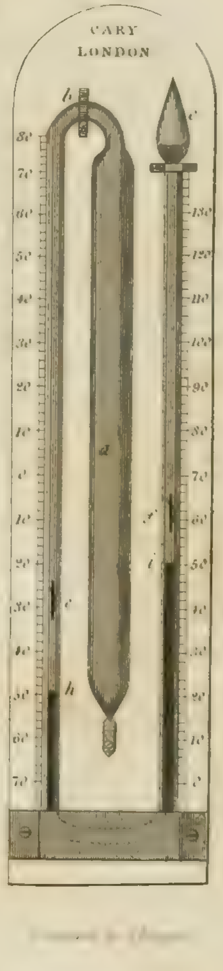

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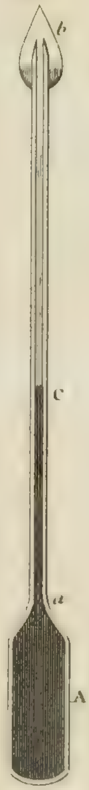

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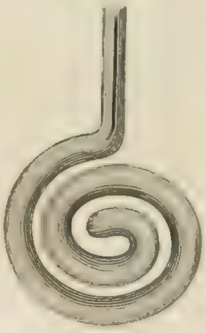

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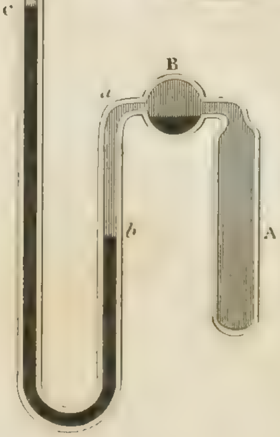

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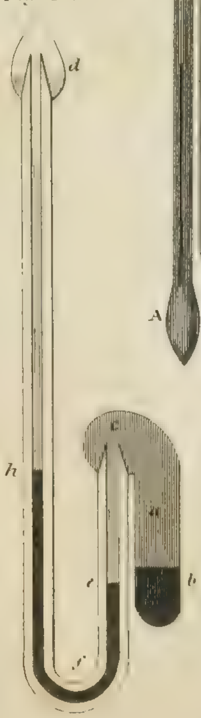

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Fig. 1.

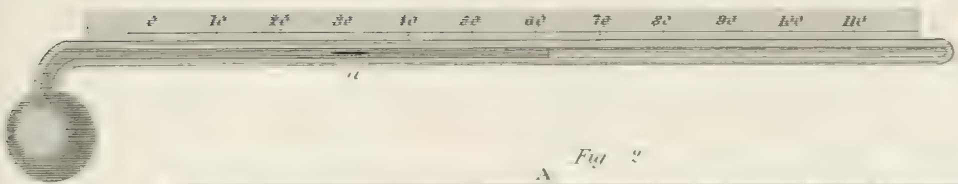


Fig. 2.

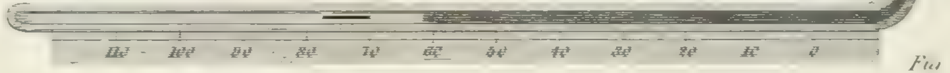
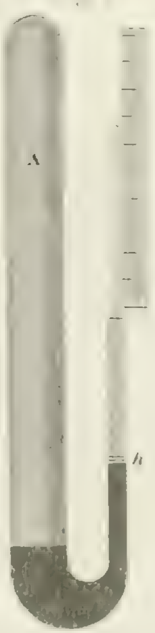


Fig. 4.



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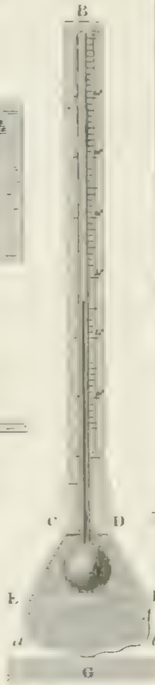

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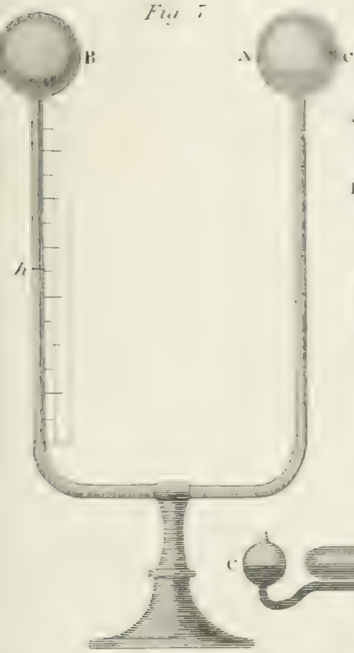

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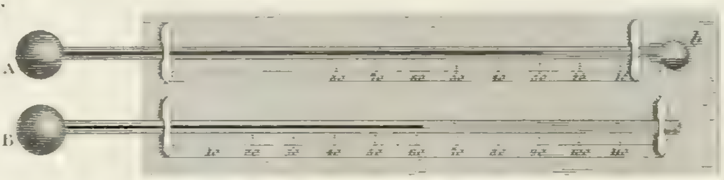

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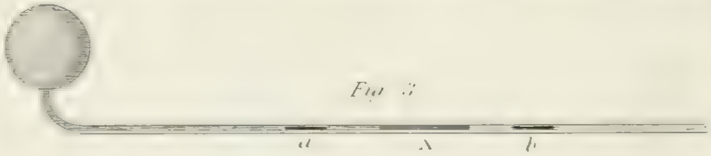
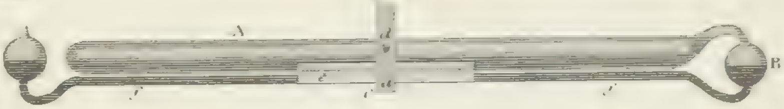


Fig. 6.

Fig. 10.



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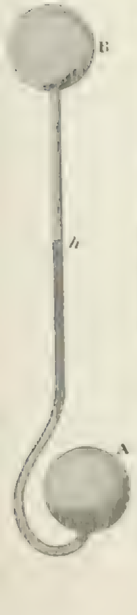

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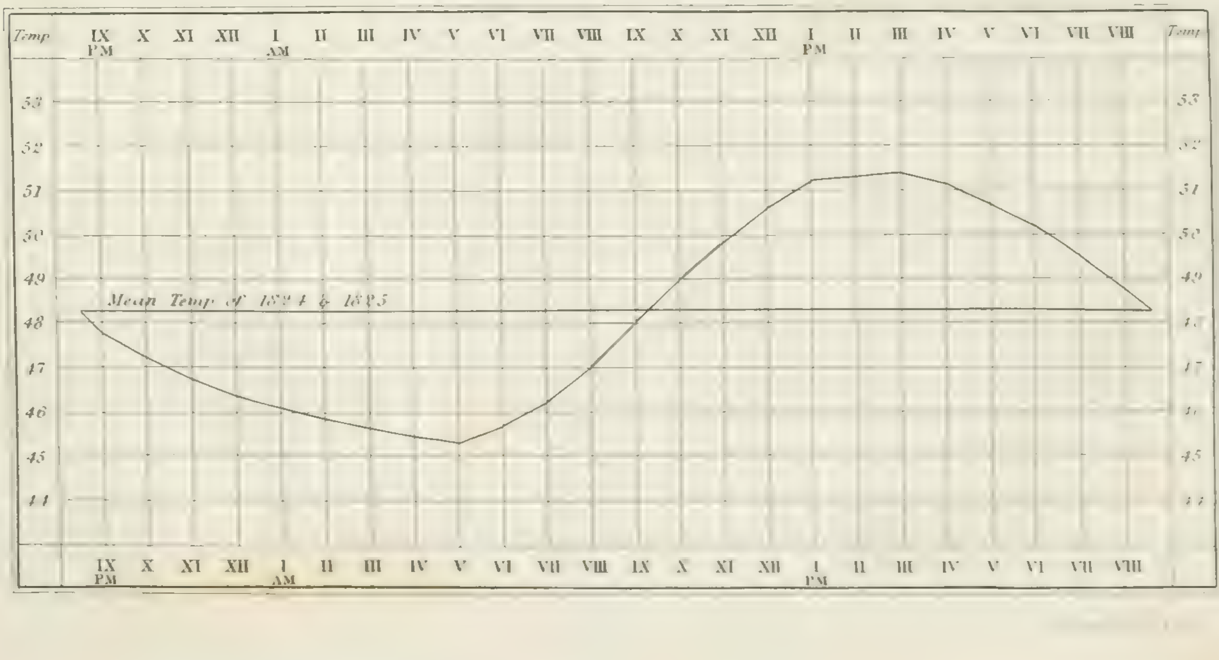
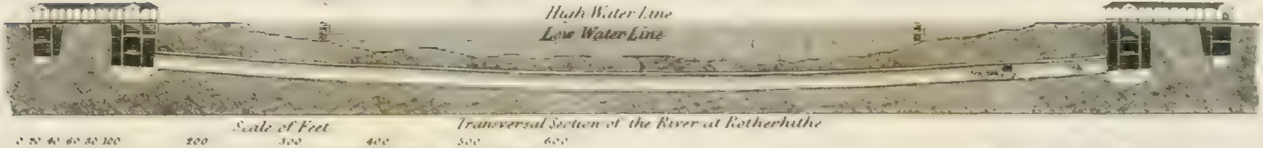


TUNNEL. TURNING. *PLATE DXXVI.*

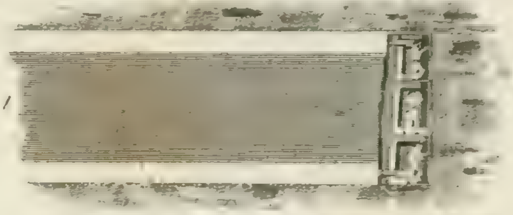
Fig. 5 TUNNEL ACROSS THE RIVER THAMES



Transversal Section of the River at Rotherhithe

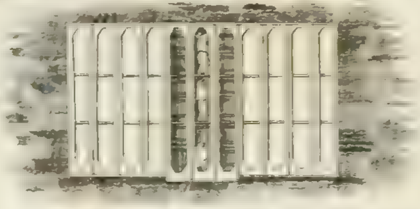
Longitudinal Section of the body of the Tunnel with the Framing preceding it

Fig. 1



Elevation of the Framing shewing the Cells in three of which the Workmen are represented in operation

Fig. 2



Transverse Section of the body of the Tunnel shewing the double Archway

Fig. 3

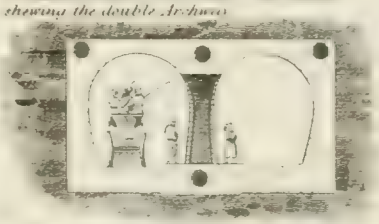
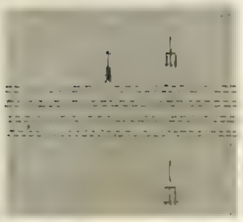
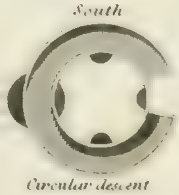


Fig. 4.



Plan of the descent into the Tunnel



Circular descent

Fig. 1

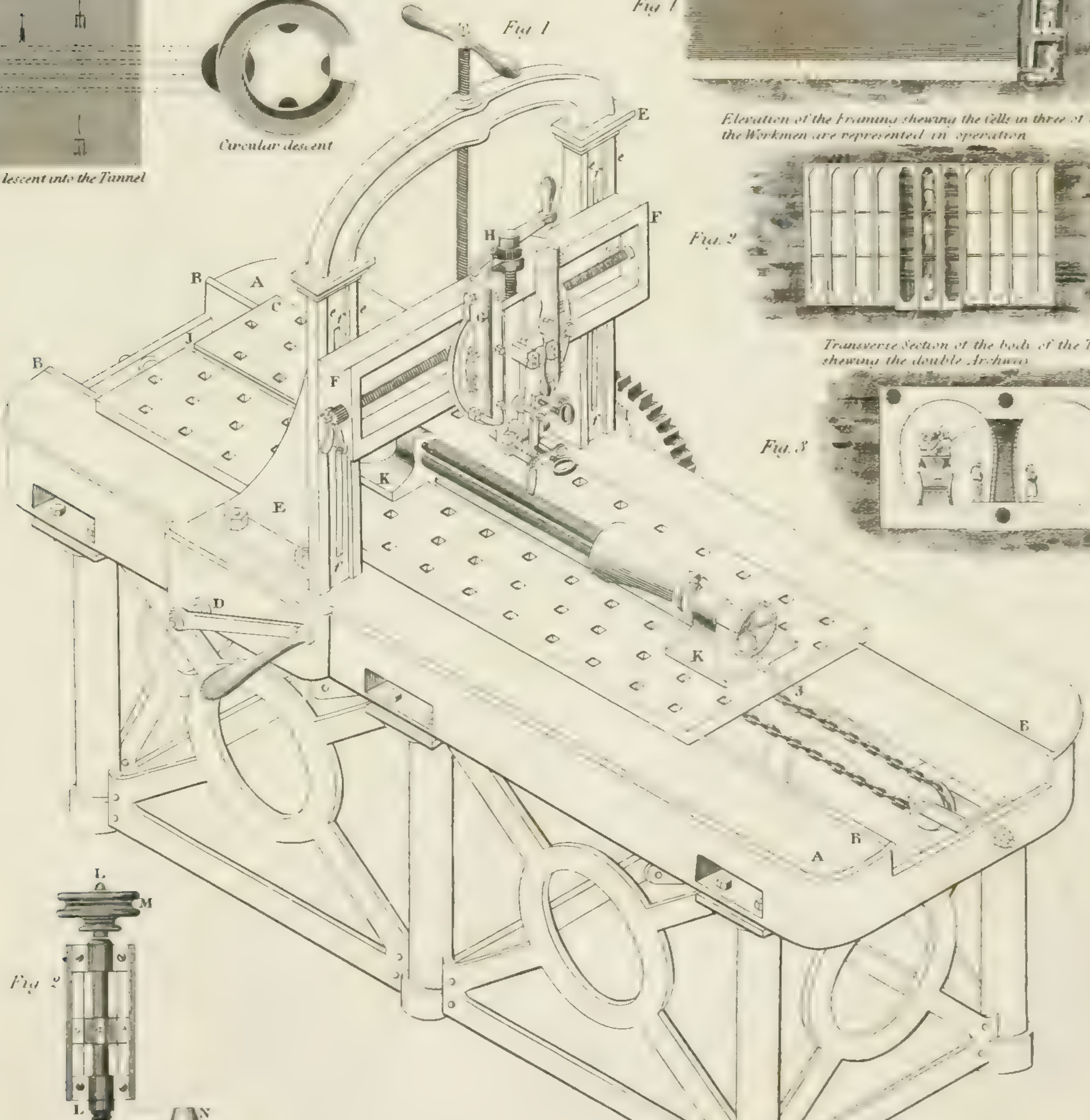
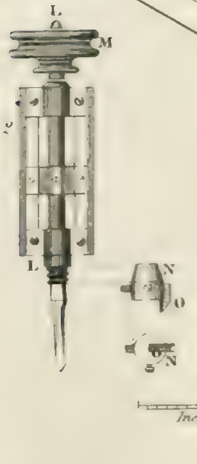


Fig. 2



Scale of Feet

Inches

TURNING. PLATE DXXVII.

ISOMETRICAL VIEW of a SLIDE REST TURNING LATHE and APPARATUS

Fig. 8.

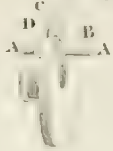


Fig. 3

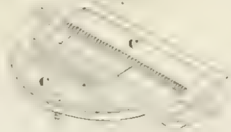


Fig. 1.

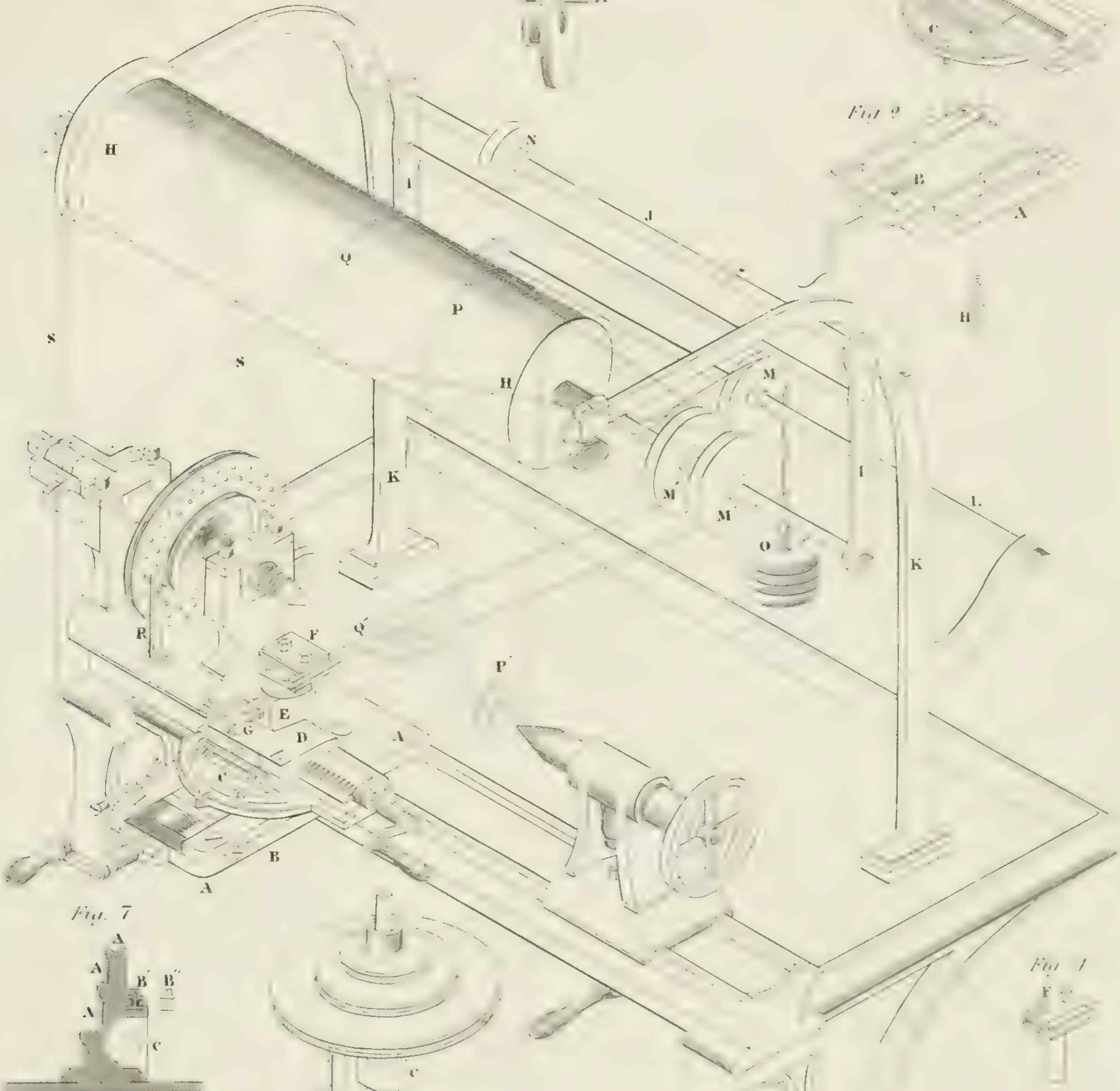


Fig. 2

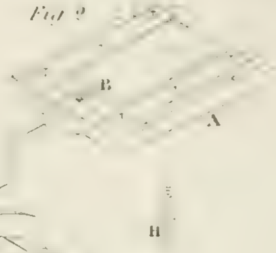
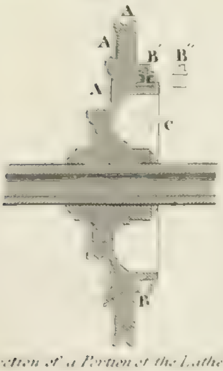


Fig. 7



Section of a Portion of the Lathe Mandril

Fig. 6

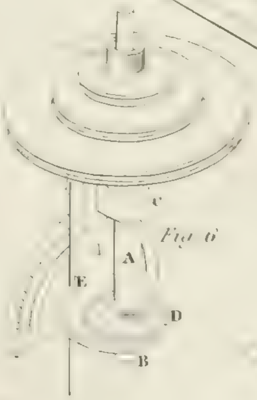


Fig. 4

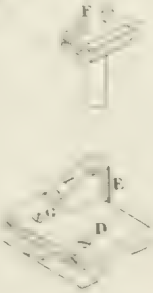


Fig. 5

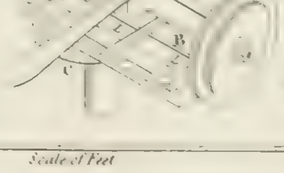
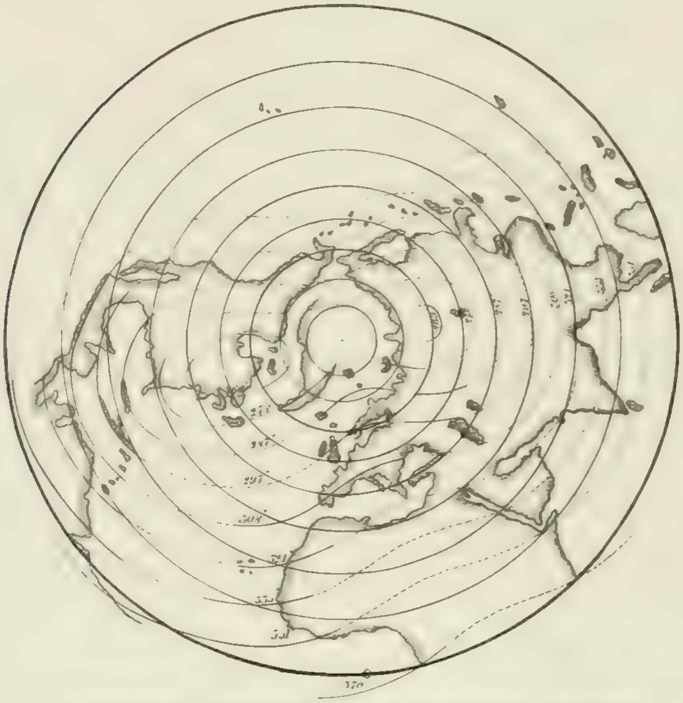


Fig.s 5 & 6 are drawn to a larger Scale than the Fig.

Scale of Feet

VARIATION OF THE NEEDLE. *PLATE DXXVIII.*

Fig 1.



Col. Beaufoy's Compass for observing the Magnetic Variation.

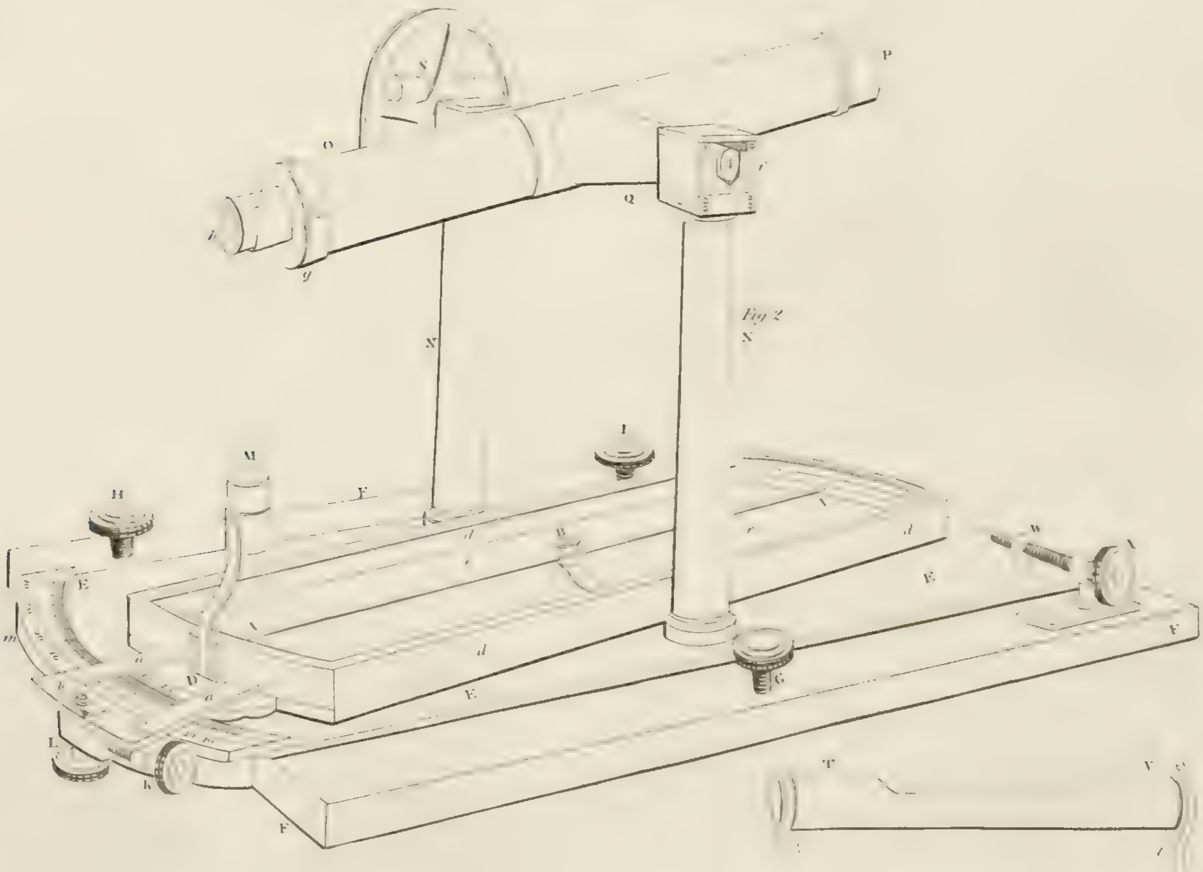


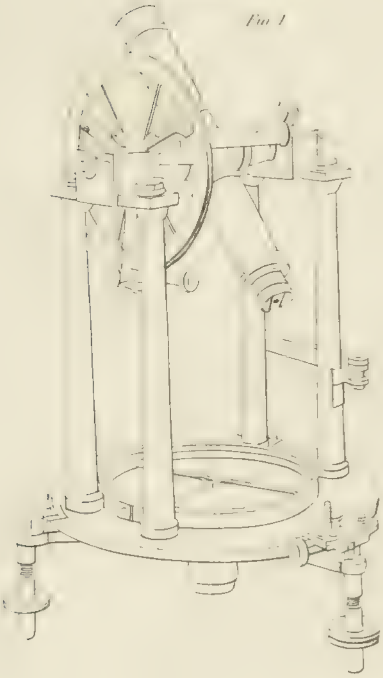
Fig 2.

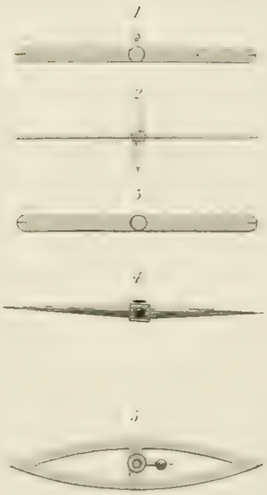
VARIATION OF THE NEEDLE.

PLATE DXXX

VARIATION TRANSIT
by Dollond

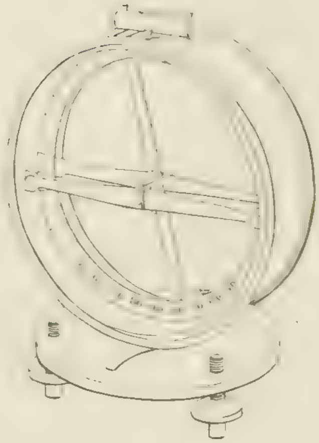
Fig 1





DIPPING NEEDLE.
by Dollond

Fig 2



DIURNAL VARIATION INSTRUMENT
by Dollond

Fig 3

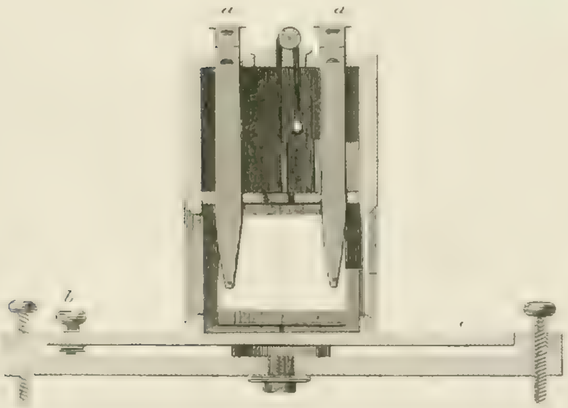


Fig 4

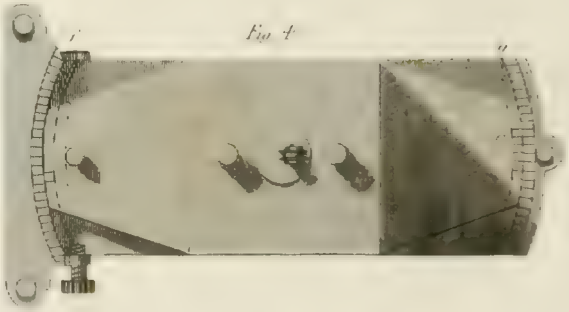


Fig 7

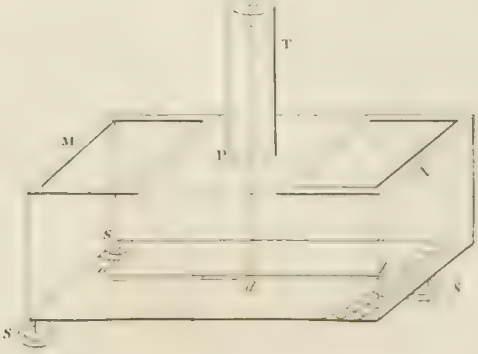


Fig 5

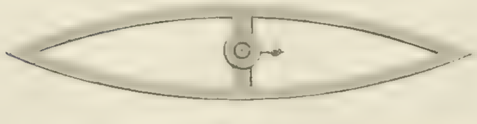
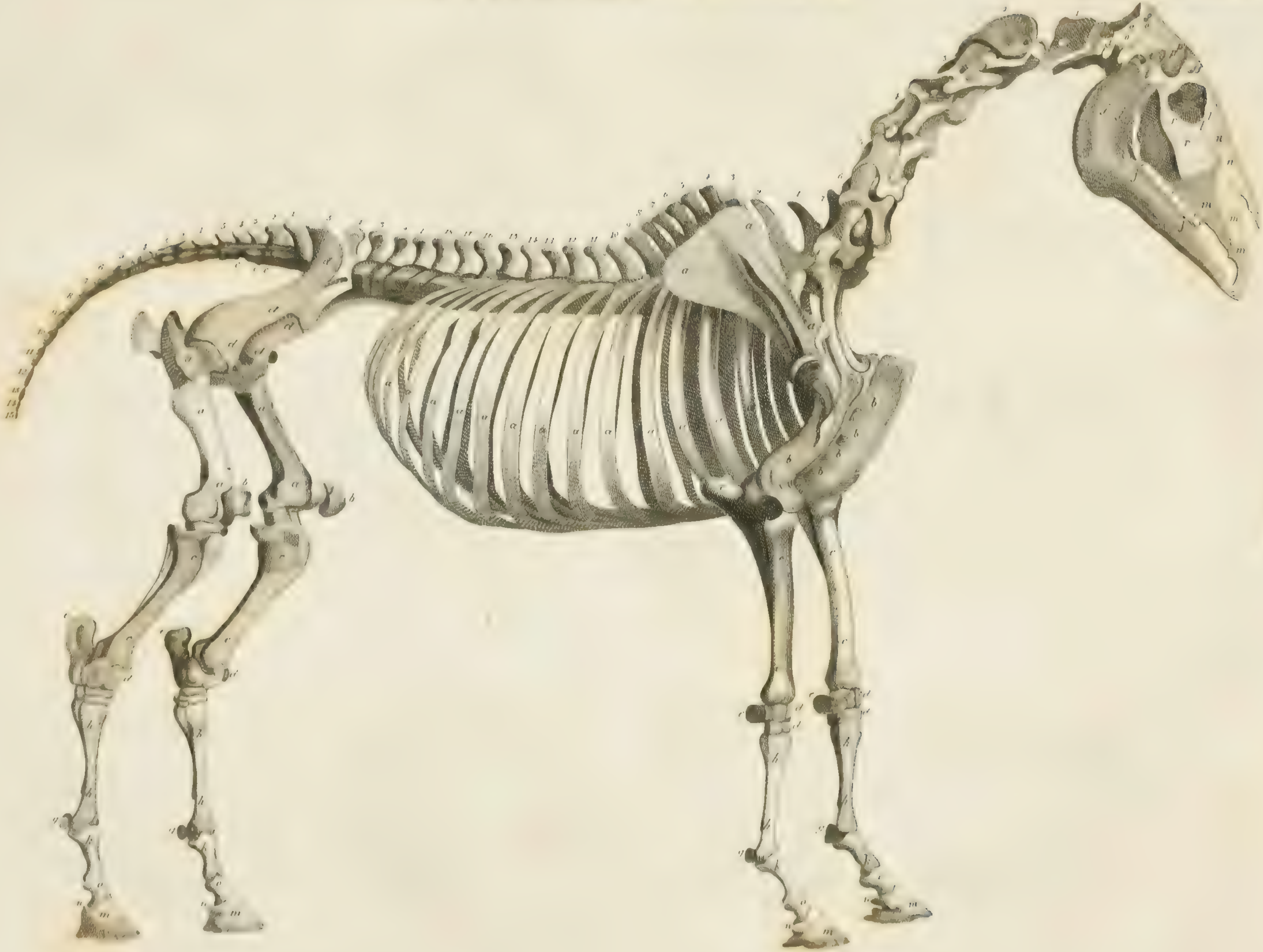


Fig 6



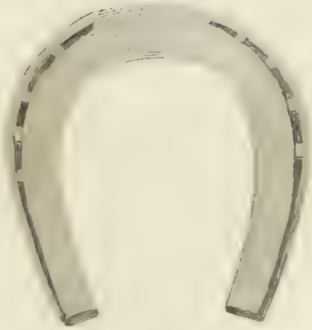


Fig. 2

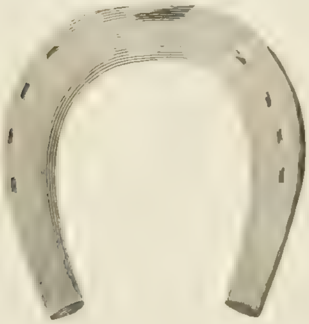


Fig. 3

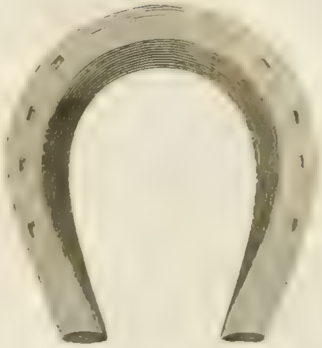


Fig. 4

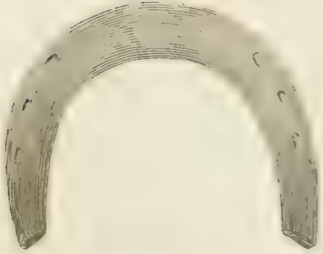
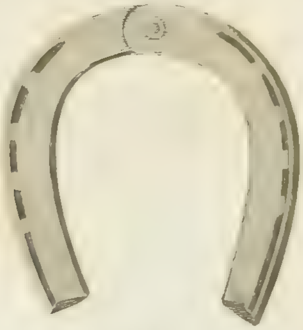


Fig. 5



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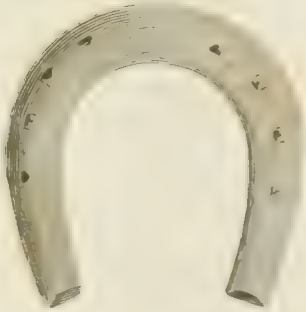

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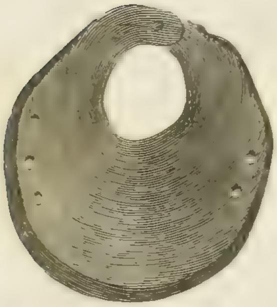

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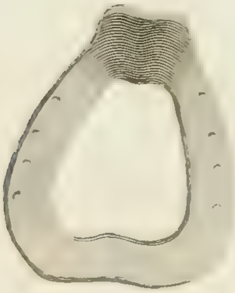

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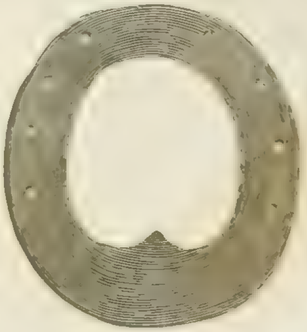

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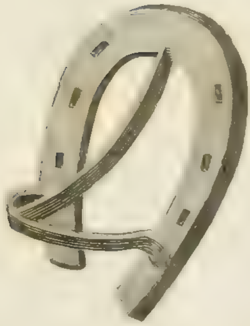

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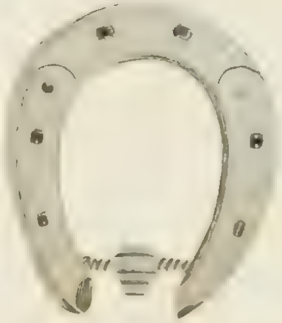

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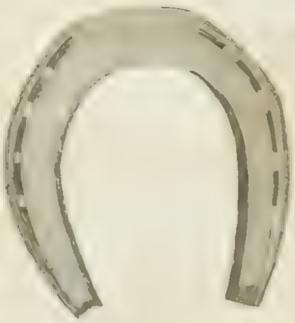
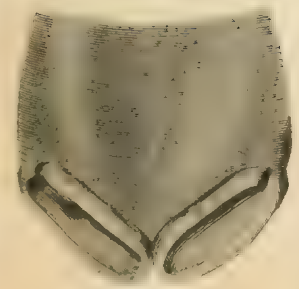


Fig 1



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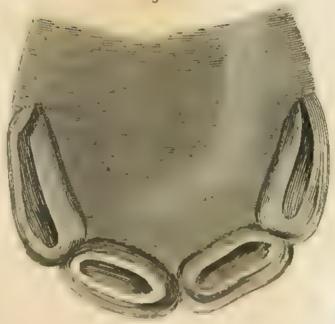

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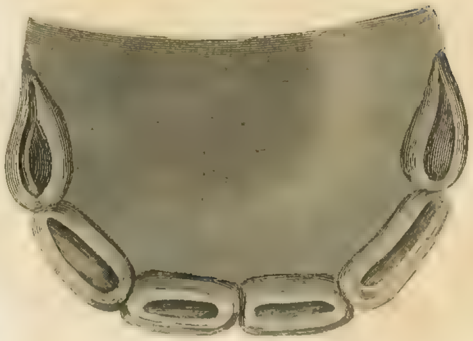

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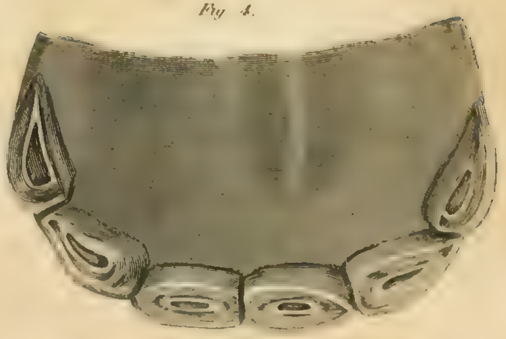
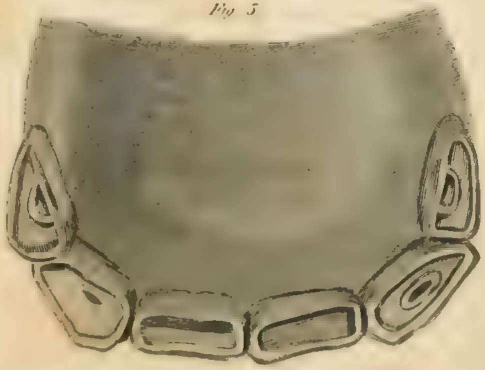


Fig 5



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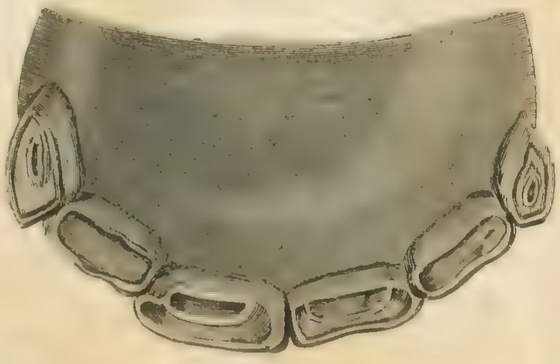

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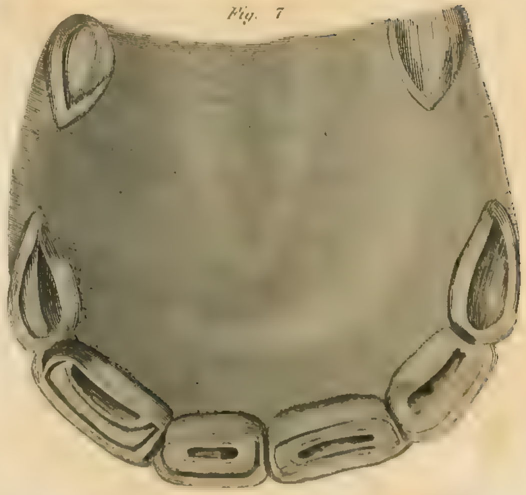

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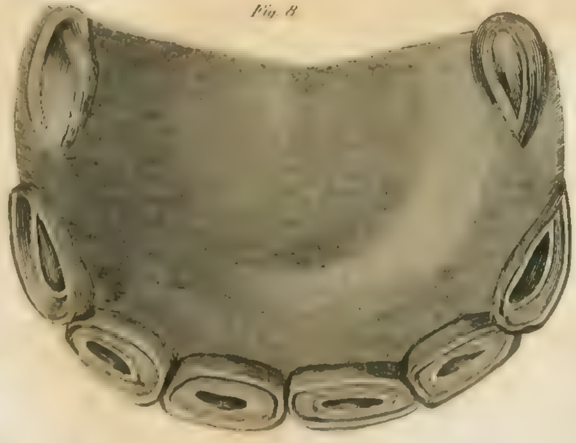

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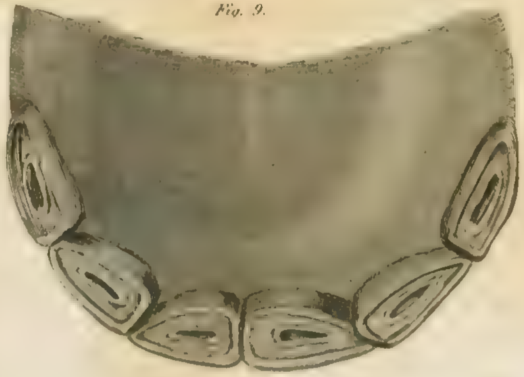

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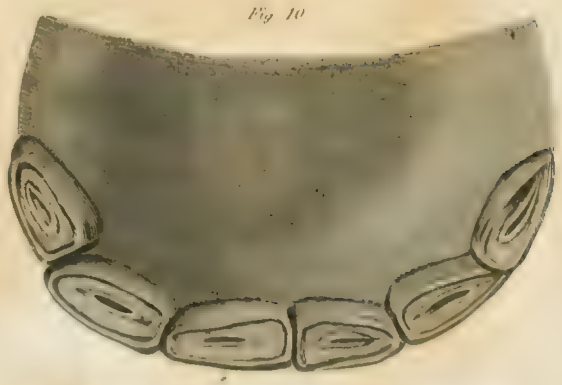

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